

AGRICULTURAL RESEARCH PRIORITIES

4. AG 8/3: S. HRG. 103-415

Agricultural Research Priorities, S... RING

BEFORE THE

SUBCOMMITTEE ON

AGRICULTURAL RESEARCH, CONSERVATION,
FORESTRY, AND GENERAL LEGISLATION

OF THE

COMMITTEE ON AGRICULTURE,

NUTRITION, AND FORESTRY

UNITED STATES SENATE

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

ON

SETTING AGRICULTURAL RESEARCH PRIORITIES AND PROPOSED
MEANS OF IMPLEMENTATION

OCTOBER 7, 1993

Printed for the use of the
Committee on Agriculture, Nutrition, and Forestry



MAY

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AGRICULTURAL RESEARCH PRIORITIES

THURSDAY, OCTOBER 7, 1993

U.S. SENATE, SUBCOMMITTEE ON AGRICULTURAL RESEARCH, CONSERVATION, FORESTRY, AND GENERAL LEGISLATION, OF THE COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY,

Washington, DC.

The subcommittee met, pursuant to notice, at 2:35 p.m., in room SR-332, Russell Senate Office Building, Hon. Thomas A. Daschle, chairman of the subcommittee, presiding.

Present or submitting a statement: Senator Daschle.

STATEMENT OF HON. THOMAS A. DASCHLE, A U.S. SENATOR FROM SOUTH DAKOTA

Senator DASCHLE. The hearing will come to order. We thank all of our witnesses for being with us this afternoon. I have a brief opening statement and then we will begin with Dr. Plowman.

The productive capacity of U.S. agriculture has been built upon research. Agricultural research has generated a stream of technological advances which have long established the United States as the world's leader in agricultural productivity. Since 1900, agriculture has moved through the animal age, the machine age and the chemical age.

Today, in the 1990's, we stand on the threshold of the biotechnological and information age. The effects of this new era of technology on agricultural productivity, the environment, and rural communities could be more profound than any of the previous technological revolutions.

Many of the advances that have made U.S. agriculture one of the world's most competitive and productive industries were supported by public investments in agricultural research. This country's agricultural research system revolutionized production through rapid and effective transfer to producers of the knowledge gained through State and Federal research and development activities.

However, these advances have not been without some costs. Just as the agricultural research system has been credited for many successes in the industry, it has also been faulted for contributing to a rapid decline in the number of family farmers and massive displacement of farm laborers and for promoting agricultural practices that sometimes can be environmentally destructive.

The demise of the agricultural industry from either economic decline or the loss of nonrenewable resources spells disaster for this Nation. In many parts of the country, agriculture and rural com-

munities face dire circumstances. Declining commodity prices, increasing agricultural input costs, ongoing environmental concerns, and the loss of jobs from rural communities all add up to a very serious situation for rural America. To compound this problem, budgetary constraints within the Government continue to chip away at agricultural support programs. Something has to be done, and short-term solutions brought about by altering our commodity programs certainly cannot be the total answer.

In 1990, Congress directed USDA to undertake a new comprehensive approach to Federal agricultural research and education activities in the writing of Title XVI of the Food, Agriculture, Conservation, and Trade Act of 1990. The research title established clear priorities, referred to as "national research purposes," for agricultural research, Extension, and teaching programs. These priority-setting provisions were an attempt to improve the direction and mission of the research system by expanding priorities to include conserving natural resources, improving economic opportunities in rural America, and enhancing the quality of life for farmers and rural citizens, as well as society.

It is imperative that proper agricultural research priorities be established. However, the implementation of the priorities is certainly the more important component of the research priority process. Otherwise, the effort is simply academic.

I have received many letters from individuals and groups who have expressed the difficulty in shifting to and/or adequately addressing the new, complex priorities of sustainable agriculture, environment, new uses of renewable resources, food safety, and others. Though I do have concerns about the difficulty of shifting the priorities, I have much more concern over what I perceive to be strong resistance to necessary change.

Facilitating shifts in agricultural research efforts and implementing new agricultural research priorities is becoming more important, since the research budget will not increase every time a new problem is tackled by the Federal research system. Congress must share in this responsibility. However, for this to be accomplished, the system itself must have a credible plan for implementing priorities—that is, shifting funding priorities to meet the public need—and have a credible means of measuring the extent to which the Federal research system is meeting these priority shift demands.

The overriding issue of this subcommittee and what we hope to address today is to what extent USDA has successfully implemented national research priorities and whether methods of accounting for USDA's implementation successes are quantitative or simply anecdotal. This subcommittee will strive to develop a consensus as to how our research system can be more fully prepared to address the needs of agricultural producers and consumers. This hearing is another in a series of steps to continue that effort.

Again, let me welcome all of our witnesses representing the Department of Agriculture and the General Accounting Office. I am appreciative of their work and their cooperation.

Let me begin this afternoon by calling upon Dr. Dean Plowman, the Acting Assistant Secretary for Science and Education. As I understand it, he is accompanied by other members of the Department and I will have him make the official introductions.

Dr. Plowman.

STATEMENT OF R. DEAN PLOWMAN, ACTING ASSISTANT SECRETARY FOR SCIENCE AND EDUCATION, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, DC; ACCOMPANIED BY E.E. FINNEY, JR., ACTING ADMINISTRATOR, AGRICULTURAL RESEARCH SERVICE; AND ROBERT CARLSON, COOPERATIVE STATE RESEARCH SERVICE

Dr. PLOWMAN. Thank you, Mr. Chairman. We do appreciate this opportunity of visiting with you today to try to clarify some of these issues of interest to all of us. I am accompanied by Dr. Finney, who is the Acting Administrator for the Agricultural Research Service, and Dr. Carlson from the Cooperative State Research Service. In addition to that, we have some other experts from both of those organizations, including Dr. Kelman from the National Research Initiative. They will be able to participate in the discussion if it is desirable.

Senator DASCHLE. Very well.

Dr. PLOWMAN. I would start out by saying that next time we appear before this committee, we could perhaps have a new name. As you heard from Mr. Espy, our Secretary, there is a reorganization plan that has been proposed to the Congress, and a component of the plan is that the Agricultural Research Service and the Cooperative State Research Service and the Extension Service will be grouped together into one organization. We look forward to that because we think it will enhance our ability to coordinate programs more closely than perhaps we have in the past, so we look at that as a positive thing.

I would like to first of all address the priority-setting phase because it is always of interest, how we do that. It is not a simple thing to explain because we take input from a whole lot of people in arriving at the things that we do.

I might mention the administration has some priority issues, and the Congress, commodity organizations, users groups, consumers, scientists, advisory committees, action and regulatory agencies of the Department, and even the needs as expressed by other executive departments. So all of those things have contributed toward what we finally do.

To put all those things into some kind of order, each of the agencies have published long- and short-term strategic plans that reflect the Department's policies and goals, and these plans are based on inputs from the science community and the external customers such as I have mentioned.

ARS is the in-house research arm of the Department, and the ARS program and mission is to develop new knowledge and technology needed to solve technical agricultural problems of broad scope and high national priority. CSRS coordinates and administers a large number of research projects as part of such things as the Hatch Act, as well as other formula funds and the special

grants in the competitive grant program. Researchers submit projects. They are reviewed and approved by CSRS scientists.

Of special interest to you in the past has been the National Research Initiative, and I would be pleased to say a few words about that. The National Research Initiative, as you know, is our competitive grants program and it is responsible for the largest single source of funding for competitive grants, so it is important that that funding be directed toward the high-priority programs.

To arrive at those initially in the first year, which was, I think, in 1990, there was a lot of activity within the Department from ARS and CSRS and the Economic Research Service and Extension and the Forest Service, and so on, formed into planning committees to develop the first requests for proposals that would reflect these national needs.

Since that time, added to that has been advice from stakeholders, and the NRI has formed user workshops which have met to discuss the specific problems and identify the researchable objectives. So, that has gone on and is a rather continuous process.

In special grants, the special grants programs funded through CSRS are targeted to specific research areas where additional emphasis is needed. A couple of examples that you will well recognize are the water quality initiative and the global climate change that were initiated a few years ago.

In addition to setting priorities, I think it is always wise for us to look back and determine if the research money has been a wise investment. There have been a couple of attempts this past year or two that I think are worth speaking about.

Just in July of this year, there was a report called "The Dynamics of the Research Investment: Issues and Trends in the Agricultural Research System." This publication outlines a lot of accomplishments and shows that this was truly an investment in doing many important things. In my testimony, I have pointed out a lot of those specific items.

Another effort worth mentioning is, in early 1992, ARS commissioned a study by an outside contractor to evaluate research projects that were completed during the period of 1980 to 1990. The contractor went out and interviewed a number of users of the research to ask them how they have applied this information in their business. It was certainly of interest to us to get a report that says that the users gave estimates of the value of ARS contributions that total approximately \$14 billion in that period of time, which in turn is certainly a good investment in terms of the money that has been spent. In my testimony, I have indicated a number of those specific things that amount to the \$14 billion.

I would like to comment, too, on a few items that this committee has been particularly interested in, such as biotechnology, sustainability, and the new uses for agricultural commodities, all items that have been given special emphasis during the past few years.

To deal with the biotechnology issues, USDA has established a Biotechnology Council which advises the agency administrators on issues related to biotechnology. Associated with that, ARS, together with CSRS, jointly administers a competitive grants program called the Biotechnology Risk Assessment Research Grants Program. The

program was authorized in the last farm bill of 1990, and is going along very well, I might say.

Sustainable agriculture—we certainly agree with its objectives. It involves a broad-based, interconnected network of technologies, practices and systems to address current and future problems facing agriculture. As the current projects reach completion—most of our projects are written for a period of 4, 5 or 6 years, we are giving more and more attention to and directing those resources freed up from the completed projects to work more directly on sustainable systems.

In the area of new uses, again, a special program formed a couple of years ago, the Agricultural Research and Commercialization Center, was formed and has just recently made their first awards. I would say that many of the awards went to companies and organizations that took the products of either ARS research or the Cooperative State Research Service research to start and enhance commercialization. So we think that is very encouraging and, again, should result in a greater realization of benefits from the research investment.

Another effort that you will well recognize is in the 1990 farm bill; it was mandated that there be established an Agricultural Science and Technology Review Board. That was done, and the Review Board now has met three times. The purpose was to identify current and emerging science issues for priority setting and provide technology assessment of current and emerging research and technology transfer initiatives.

The Board has met, as I indicated, and they are just completing their first year of operation and are prepared to make an initial report that we are told will be issued before the end of this calendar year. We look forward to that activity.

Mr. Chairman, in summary, I would just echo some things that you said. The U.S. agriculture system is one of the largest positive elements in the our trade equation. It has assets in excess of \$1 trillion. It provides almost 20 percent of our Nation's employment. It is efficient and remains a mainstay for food and fiber production, and I would add that much of our success in the agriculture industry is founded in the strong, long-term commitment to agricultural and forestry research systems. The great success we have in efficiency is not an accident; it is because of the system that has been developed and funded by the Congress over these many years.

I would also add that the job is certainly not finished. There are many more issues that we need to emphasize. We are in a whole different ball game of producing under sustainable systems, reducing our inputs, having a safer environment and all of those kinds of things, so there is still a large agenda that we need to work on.

That completes my prepared statement. We look forward to responding to questions and participating in the discussion.

Senator DASCHLE. Thank you, Dr. Plowman. I appreciate your opening remarks. Let me say that, as is the practice in the committee, we will wait until all the testimony has been provided and enter into a general discussion about many of these issues.

I notice that you took highlights from your statement. For the record, your entire text will be made part of the hearing record this

afternoon, as will your answers to questions that we sent to you on August 23rd.

Dr. PLOWMAN. Thank you, Mr. Chairman.

Senator DASCHLE. I appreciated the thoroughness of your responses and your cooperation in having that prepared. It was helpful to us.

Senator DASCHLE. As I understand it, the Associate Director of Food and Agricultural Uses for the General Accounting Office will present testimony from the GAO. He is also accompanied by a number of people from the General Accounting Office, and I welcome him at this time.

STATEMENT OF ROBERT A. ROBINSON, ASSOCIATE DIRECTOR, FOOD AND AGRICULTURAL ISSUES, RESOURCES, COMMUNITY, AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE, WASHINGTON, DC; ACCOMPANIED BY MARY ROY AND EUGENE WICHMANN, SENIOR EVALUATORS, FOOD AND AGRICULTURAL ISSUES, GENERAL ACCOUNTING OFFICE, WASHINGTON, DC

Mr. ROBINSON. Thank you, Mr. Chairman. If we might, this is a statement for the record with color graphics that you might want to use as we go through.

Senator DASCHLE. Without objection, that will be made part of the record as well.

[The color graphics are retained in the committee file. They are reproduced sans color in Mr. Robinson's prepared statement, pp. 47-60.]

Mr. ROBINSON. Given the vast promise and importance of the agricultural sector, we are very excited to be asked to be a part of the oversight process. By GAO standards, at least, we have a somewhat unorthodox testimony format today, and before I go any further I think a couple of things are in order.

First of all, I would like to introduce Mary Roy, our senior evaluator who has done the work that has led to the preparation of this statement. Gene Wichmann is our technical wizard and he will be running the computer slide presentation that we will be using today.

I don't know what your angle is on the screen.

Senator DASCHLE. I can see it fine.

Mr. ROBINSON. Okay, that is fine. As I said, our testimony today is built around a computerized slide package that has been put together to provide you with an informational framework to facilitate your oversight of USDA's research activities.

In the 10 minutes we have available today, we want to present three things: first, a brief background on the structure and magnitude of the current agricultural research effort; second, a discussion of the new research objectives that have been introduced in recent years and how well our research system has adjusted and responded; and, finally, a brief discussion of the factors that have hampered efforts to shift priorities and address these new requirements. With that, let us get started on the slides.

Beginning with the structure and budget, this first slide portrays the current agricultural research structure in USDA. As you can see, the research effort is conducted by five agencies, shown in the

white blocks, under four different assistant secretaries that are blocked in green. In this arrangement, only the Secretary is accountable for the full scope of the research effort and has the global view and ability to coordinate the entire operation.

This next slide shows the rough breakout of the nearly \$3 billion spent by Government on agricultural research. As you can see, there is roughly a two-thirds/one-third split between the State share, shown in purple, and the USDA share, shown in green.

The next two slides elaborate a bit on the two elements of this last pie chart. Now, this slide addresses the \$1 billion USDA share. The Agricultural Research Service, shown in the purple section of the pie, represents the largest component. While often overlooked, the second largest USDA effort is managed by the Forest Service, shown in yellow, followed closely by the Cooperative State Research Service, shown in green.

Next, we want to present some additional information on the roughly two-thirds of the research effort, or about \$1.9 billion, managed by the States.

Senator DASCHLE. Before you do that, Mr. Robinson, going back to that previous chart, is there any way from that chart to determine the degree to which research is basic and the degree to which it is applied?

Mr. ROBINSON. Certainly, we don't have a graphic for that. Mary, what is our capability there?

Ms. ROY. No, we don't have a breakout in this display here to do that, and I think as you see the rest of our presentation, you will understand why we don't have that right now. So if you would allow him to continue, he will answer your question.

Senator DASCHLE. Okay.

Mr. ROBINSON. If not, we will come back.

This is, again, the State share. If you look at the bar chart at the top, the States themselves contributed a little over half of the funds that make up the portion that they manage. While this half is provided by the States, you can see that much of the State effort is made possible by grants from USDA and other Federal agencies, as well as the private sector, the smaller components at the top of the bar.

Roughly 30 percent, as you can see, of the State share comes originally from the Federal Government. Following the red arrow down the slide, the pie chart at the bottom breaks out that portion of the State funds provided by USDA. You can see by focusing on the orange portion of the pie that most of the USDA funds are distributed to the States by formula, with little direct control by USDA.

Now, I want to turn to the second portion of our presentation, the priorities guiding the distribution of the Federal research dollars. Historically, the agricultural research system, as you pointed out earlier, was focused almost exclusively on increasing production or, as it has often been characterized, growing two blades of grass where one grew before.

In the 1970's, new societal concerns emerged that would broaden the desired outcomes from the agricultural research effort. As can be seen on the left half of this slide, in the 1977 farm bill the Congress identified a host of new objectives—expanding export mar-

kets, devising more environmentally benign practices, improving human nutrition, et cetera. Turning to the right half of the slide, it also established two bodies to advise USDA on research priorities.

This next slide shows the consistency in the congressional direction to the Federal research community that has carried through to the 1990 farm bill. Comparing the 1990 farm bill provisions, shown on the right, to the 1977 provisions, shown on the left, you can easily go across side to side and see the similarities.

The 1990 farm bill also substantially expanded the number of advisory bodies set up to advise USDA on research priorities. If you look at the originally established bodies, the top two, that were reauthorized in 1990 and add to it the Agricultural Science and Technology Review Board and the 21 specifically oriented bodies created in 1990, by our count there are now 24 officially established sources of advice to USDA. With this many advisory groups in place, you can see how USDA might find it difficult to sort through all the differing voices to devise a coherent strategy.

The next couple of slides give you some information on current research funding priorities and demonstrates how little these priorities have changed in the last 10 years.

Senator DASCHLE. Could I ask you a question about those advisory boards?

Mr. ROBINSON. Sure.

Senator DASCHLE. To what extent were you able to determine the degree to which advice the USDA was getting from all of the disparate boards was conflicting?

Mr. ROBINSON. We talked about that earlier this morning. What we did in the course of our review—we certainly did not analyze the operations or the directions coming from each of the individual boards. We spent a fair amount of time, however, talking to USDA people about this issue, and I have to tell you there some grumbling that we encountered as far as the usefulness of that advice that was coming from them.

The characterization given to us was that much of the advice was so general that was it was awful hard to make an actionable decision on the basis of what was being communicated. So I can't say there was a lot of inconsistency. It was so general that you could read almost anything into whatever was being said.

Senator DASCHLE. Dr. Plowman, just on that point, how does reinventing government and the reorganizational plan affect all of those boards at this point? Are they all grandfathered or protected?

Dr. PLOWMAN. Well, some of the boards are mandated by the Congress, and at the same time the money to support many of these boards has been decreased. So we have been in a position of evaluating those and will be recommending that we don't have as many.

Senator DASCHLE. What is your time frame for making recommendations of that kind?

Dr. PLOWMAN. I would say within the next 2 or 3 months.

Senator DASCHLE. So we could make your recommendations part of the overall restructuring of USDA?

Dr. PLOWMAN. That would be a useful thing to do.

Senator DASCHLE. Well, I would be very interested, as soon as your recommendations can be made available to this subcommittee, to have the chance to talk with you about them.

Mr. ROBINSON. As you go forward in that effort, one issue that we talked about was the National Research Council's process. They have a single agricultural board that establishes ad hoc committees to examine specific issues as needed, in contrast to this vast array of separate boards.

Senator DASCHLE. I am sorry for the interruption, Mr. Robinson.

Mr. ROBINSON. That is fine. This first slide demonstrates the funding percentages for ARS which, of course, is the biggest source of USDA funds. As you can see—the colors have merged a bit here—by combining the green and the orange, the sectors toward the bottom of the two charts, plant and animal productivity got 60 percent of the resources in 1982, which is the top pie, and 57 percent in 1991, the bottom pie. So you can see things are staying roughly the same.

Likewise, the next slide shows roughly the same picture for CSRS' competitive grants program, that program that is supposed to be the most responsive to new priorities. Once again, as you can see by examining the combined green and orange portions of the two pies, traditional plant and animal research is receiving the lion's share of the funds.

Now, if I could just take a moment to break from the flow of the presentation here, I would like to make an important point about the data in these last two slides. This and the previous slide are based on the best available data that we were able to come up with and certainly give you some perspective on the limited scope of the priority shift that has taken place over the last 10 years.

Having said this, however, I would like to suggest a wholly different approach to assessing USDA's implementation of research priorities, one that we think might be more productive. Assessing the implementation of priorities by examining the classification of research efforts into various broad categories just doesn't get you very far, in our mind. Any given research project can be classified in many different ways. Consequently, the summary numbers on the percentages of effort devoted to these categories may not be all that meaningful.

For example, we have talked to some folks who submitted a proposal and, to change the classification of the proposal, shifted a few words around. The very same work was being done, but it got classified in a wholly different way. So, instead, we feel a better approach might be to establish measurable goals and objectives for each of the research priority areas and then assess achievement of those objectives; in other words, measuring outcomes rather than inputs.

Converting to an outcome-based approach, in our mind, would also have the added benefit of broadening the constituent base from just farmers to a whole new set of customers and stakeholders. In any event, the numbers that are available and the experts we have consulted suggest that the progress in shifting to new priorities has been relatively slow.

I would like to move to the final portion of the presentation. This slide sets forth four possible reasons for the system's relative lack

of responsiveness to new concerns. First, as highlighted in the red-shaded line there, there is no Department-wide research agenda or vision to guide where agriculture needs to go in the next 20-or-so years. Hence, there is no central focus, no measurable goals, and hence no easy way of assessing overall progress.

Next, there is no management information system to support the priority-shifting process. Thus, even if we had outcome goals, we would not be able to track progress because there is no system for collecting the data necessary to measure it. I understand this issue will be discussed in more depth by a later witness.

Third, there is an inherent inertia in the system, and here I am referring to the tendency of research institutions to pursue issues consistent with their training and experience instead of necessarily pursuing new issues outside this training comfort zone. Finally, USDA has also pointed to congressional earmarking of funds for specific projects as handicapping its ability to change priorities over time.

Mr. Chairman, if you will just permit me a brief moment for some concluding remarks, I am afraid it is going to be very repetitious. It is going to sound like the things you just said, but let me go ahead anyway.

As you stated, our Nation's agricultural research system has been the cornerstone upon which our tremendous agricultural successes over the past century have been built, but the world is changing. As we stand at the onset of the next century and, in fact, the next millennium, the agricultural sector is literally bursting with new opportunities and new challenges, opportunities and challenges that could spawn whole new rurally based industries, new nutritionally based strategies for improved human health, more sustainable agricultural practices, et cetera.

If our agricultural research system is to help us take advantage of these opportunities and achieve the same international preeminence it has maintained during the previous century, it will likely have to shift its priorities and accept a new focus. And if this objective is to be accomplished, we believe some very fundamental obstacles will need to be overcome.

We thank you for this opportunity.

Senator DASCHLE. Mr. Robinson, I have to say that was extraordinarily helpful testimony. In addition, Ms. Roy ought to be commended and others who have had a lot to do with this presentation. It is concise, it is extremely revealing to me and very, very helpful. I appreciate it.

I am in the middle of a vote. I am going to have to excuse myself momentarily, so at this time the subcommittee stands in recess for about 10 minutes. I will be right back.

[Recess.]

Senator DASCHLE. The hearing will return to order. Having just had the opportunity to hear Director Robinson, we will now call on Dr. Terry Nipp, who is the President of AESOP Enterprises and we are very appreciative of his presence here this afternoon. Dr. Nipp, thank you for coming.

STATEMENT OF TERRY L. NIPP, PRESIDENT, AESOP ENTERPRISES, LTD., ON BEHALF OF THE EXPERIMENT STATION COMMITTEE ON ORGANIZATION AND POLICY AT THE NATIONAL ASSOCIATION OF STATE UNIVERSITIES AND LAND GRANT COLLEGES, WASHINGTON, DC

Dr. NIPP. Sir, I appreciate the opportunity to speak before you and the committee on behalf of the State agricultural experiment stations which, as you know, are a part of the National Association of State Universities and Land-Grant Colleges system.

I am happy, in particular, to speak on their behalf in this discussion about research priorities in light of the slides that we have just seen where it is very clear that the States, which are a large, diffuse, and complex system, actually contribute and make up two-thirds of the agricultural research that is being done in this country. Clearly, any discussion about effective priority setting or implementation has to take into account how that system works and how it interfaces with the Federal funds that are being expended.

In the time that is available, which is very short, I would like to suggest, if you will allow, that I submit the full text of my statement for the record.

Senator DASCHLE. Without objection, it will be made part of the record.

Dr. NIPP. I will try to summarize a few things, and I think what might be most helpful is if I focus on how we try to do priority setting in this large, complex system. I would start by holding up a document entitled "Research Agenda for the 1990's." The State Agricultural Experiment Stations have a process whereby they develop their agreed-upon agenda on an evolving 4-year basis. Every 4 years, they go through a complete overhaul of the research priority-setting process. The last time this was done was in 1990, and I will provide this for the record if that is desired.

Every year, they go through a process of modifying that plan. Every 2 years, they go through a fairly substantial modification. This is the 2-year midterm update of the plan that I have just mentioned. I will talk about how that plan is evolved in just a moment.

As you realize, the State Agricultural Experiment Stations have to be very responsive not only to the Federal sources of funds, but to the mandates that are put on each of them individually by their State legislatures and by their State governments, which are not always in synch with the Federal mandates.

In addition to that, they have to be responsive to local interest groups in their individual States, both in the environmental community and in the traditional farm community. In addition to that, they have to merge a portfolio of different funding sources. As was suggested here, about a third of the money comes to the States from Federal sources. That means the remaining two-thirds of the money comes from other sources who also have a highly vested interest in how those funds are spent.

Now, we were talking rather glibly about a third here and two-thirds there. In fact, every State is phenomenally different. We have States where no more than 2 percent of their total funding is coming from traditional Federal sources. Those States are a tad indifferent to whatever the Federal priority-setting processes might happen to be. We have other States where two-thirds of their funds

are coming from the Federal sources and they are extremely sensitive to what the Federal priority-setting process is. I simply point out that the process is complex.

Because we have so many different sources of input and because we have to somehow integrate them all, we have a very well-defined series of mechanisms for listening to everybody and trying to integrate the different pieces. To that end, we are very careful to listen to commodity and farm organizations, natural resource and environmental groups, professional and scientific societies, and our own regional associations of Experiment Station Directors.

To this end, we hold a series of customer conferences, and basically what happens is we send out invitations to people who have been identified as leaders in these different communities and we ask them to come together and interact with us and tell us what they perceive to be the priorities of their respective communities.

We are also trying to integrate this with the Federal agenda. So how do you take all this input and piece it together with the input of all these communities? One way that has been tried so far and has been in place since the 1990 farm bill, is that we took the priority areas established from the National Research Initiative, the six fundamental priority funding areas, and basically have asked all these different interest groups within those categories, "What do you want us to do?"

We were talking a moment ago about plant sciences. Well, what about plant sciences? What inside of the plant sciences category is important to the commodity groups? What inside of the plant sciences category is important to the environmentalists? How are those different? How do we do both? How do we do one or the other? How much of each do we do?

This process was initially, actually, to respond to the National Research Initiative. The whole customer conference idea started there and it was done first by the States for the National Research Initiative so that we knew what it was we were supposed to be responding to. But the concept seemed to work so well that we have now expanded that to our total agenda, not just for what is being done in the Initiative, but for the recommendations we make for our collective system as a whole, which I think is a very exciting and a very new development.

In addition to that, we solicit written input not only from these leaders that we invite from the groups, but broadly from all the different interest groups that we are aware of. I would hasten to add that in the last several years we were very careful to ensure that members of the sustainable agriculture community were invited to participate or to nominate individuals to serve in each of the different six categories; this summer for the first time there was a customer conference specifically with the members of the sustainable agriculture community to ask what their opinions were not just about one category, but for the whole research agenda, and how they approached this topic differently from how we might hear it from other individuals.

In addition to that, we go back to our own community and we ask every State Agricultural Experiment Station Director and his or her shop to give us their list of priorities, what do they see as the looming issues that are on the horizon, and how they rank a

list of priorities. We do analysis so that we can say in the Southern Region these are the priorities, versus in the Northern Region these are the priorities, versus the Western Region, and so on.

Now, having said this, we are very aware of the fact that it is extremely important to listen to what all the possible clients might have to say about what you should be doing in research today. But it is equally important for us to look a little bit over the horizon and ask what we need to be doing tomorrow because it is a complex system. It is a highly invested system. It is hard to turn. It is hard to change quickly, and if you anticipate you are going to have a dramatic problem, it is very important that you not wait until the problem is on you before you start to respond to it.

I would use as one example of successful foresight the fact that one of our committees, which is focused on doing exactly this, met in 1982 and determined that one of the issues we would be asked to respond to quickly would be ground water contamination from agricultural sources of pollution. They began a process in 1982 that culminated in a document in 1985 that broke out in great detail exactly what the critical missing pieces were in research that would enable us to better respond to dealing with agricultural sources of pollutants. We point this out as an item of pride, in that that was at least 3 or 4 years before there was, in fact, a water quality initiative that was engaged in by all of the different administrative agencies.

We supported the water quality initiative; we continue to support the water quality initiative. The point is simply that it is important for us and the Federal agencies to look farther down the road than simply obtaining input for what the concerns are today.

What we try to do is take all of the input that we have received from the consumer conferences, all of the responses we have had to the questionnaires and the surveys that we have sent out, all of the input we have from our own Directors, and the results of the futuring conferences, and this is what we compile once every 4 years and try to put together. We bring about 100 people together from the research community, the different societies, from our own leadership, and from some of the Federal agencies, and that is what culminates in this document that we call the 4-year plan.

This was just completed again this summer, in August, in Texas. We hope to have a draft of that available by November, and a final copy of it will be available in January and we would, of course, be happy to provide that at any time that the committee would wish it.

In this process, I would like emphasize again that we were very careful in the 1990 plan to take a look at the priority categories that were established in the 1990 farm bill and structure our response based on what was in the Academy report and what was in the 1990 farm bill.

Now, a question should be asked, and that is, once we have gone through all of this and we have established this very nice national list of priorities, what do we do with it? How does this get implemented at a State level? How does this get implemented in the regions? In fact, it varies quite a bit because we are not a top-down management structure. As an association or a confederation, we do not get to say these are the national objectives and now all of you

are going to fall into line. But we do provide this as a set of references and guidelines, and individual regions and States have the choice as to how much they buy into this.

I would hold up as a second example, the Strategic Plan that was developed specifically for the Southern Region. They are the first region to take the national plan as a format and then say, within these categories that we have all agreed to for our national priorities, how do we implement that within our own individual region. They have taken the national priorities and they have said, for this category, this is what is important in the South, case by case.

So if you talk hypothetically about environment as an important thing to do, or protecting the environment, they take that the next several levels down to the process and they say, "All right, if you are going to talk about protecting the environment, what does that involve?" They come up with a list of things that they consider to be high priority, protecting and enhancing water resources being one, promoting compatibility of agriculture and natural resources and the environment being another. That, however, remains fairly generic, so within that they take it down yet another level and they talk about specific applications of research that are needed in the southern region based on the environmental and the social conditions that are unique to that region. So there is a very serious attempt to adapt it and to be very specific.

The remaining issue, though, is, again, what do you do with all of this? The planning document, as such, is a discussion of where we believe the different clients want us to go, the things that people want us to work on, but you don't get to do that unless you have the money or unless you are able to redirect the money. So, of course, we have our own budget committees, we have our own budget-determining processes, and every year the land-grant university communities develop their recommendations for the budget for the Department of Agriculture for Science and Education for those funds that would be made available to them through CSRS. We do not comment on ARS. How this functions under a new structure would be interesting to contemplate.

I would hasten to add that for the last number of years, the land-grant university community and the Experiment Stations have argued very strongly for substantially increased funding for sustainable agriculture, for integrated pest management, and for related environmental technologies, including water quality enhancement.

It has been suggested here that our system is slow to respond, and I think that is true. In some ways, we can't do anything about it simply because we are so big and there are so many different pieces to it. Another constraining factor, in addition to inertia, is the very difficult budget situation that many States find themselves in in advance of the difficulties we are having at the Federal level.

There is not a lot of margin and, in consequence, in many States what we find is that the budgets of the universities are already overwhelmingly locked up into salaries, and they are at a point now where any substantial change in goals or priorities either requires new money or it requires letting people go and replacing them with new people.

We have talked through the years about retooling and retraining, and we talk about this whenever we get into defense conversion and issues of that sort. It is possible, but that, too, takes a decision at a national level that we are going to take this resource and reharness it, and that takes resources as well.

Because the land-grant system is often seen as being reluctant to change, I would like to quote for a moment here one of their own documents from the planning process. "The 1990's offer a combination of opportunities and challenges that are far greater than ever experienced in the history of the State Agricultural Experiment Stations. Changing and expanded responsibilities, in addition to the continued need to maintain and enhance the use of current technology, requires new approaches to old problems. Emphasis must be placed on broader societal concerns and goals, especially in the areas of environmental quality and food safety."

As we and as the Congress and as this administration struggles with reorganization and with the questions of where we are today and where we are going, we look forward to working with the Congress and the administration in implementing a new mix of research priorities that will effectively address the challenges of today and tomorrow.

Senator DASCHLE. Thank you very much for your comprehensive statement, Dr. Nipp.

Dr. Neill Schaller is here to represent the Wallace Institute for Alternative Agriculture, and that is in Greenbelt, Maryland. Dr. Schaller, thank you for being here.

**STATEMENT OF NEILL SCHALLER, ASSOCIATE DIRECTOR,
HENRY A. WALLACE INSTITUTE FOR ALTERNATIVE AGRICULTURE,
GREENBELT, MD**

Dr. SCHALLER. Thank you very much, Mr. Chairman. I represent the Henry A. Wallace Institute for Alternative Agriculture in Greenbelt, Maryland. We are a private, nonprofit organization dedicated to increasing the understanding and adoption of sustainable agriculture. Before joining the Institute in 1990, I served in the U.S. Department of Agriculture for over 20 years, the last 2 as Director of the Sustainable Agriculture Research and Education Program in CSRS. Although I speak for the Institute's Board of Directors and staff, the following remarks are my own.

We commend you and the subcommittee for your diligent attention to this whole matter of research. We do so because we feel very strongly that the sustainability of agriculture, our primary interest, depends heavily on the availability of sound information of the kind that should come from the research system, information to give farmers guidance on choosing sustainable farming practices.

In talking about sustainable agriculture research, let me invite you to listen to a brief conversation between three fictitious characters whom I have named for this purpose Sustainable Sam, Test Tube Tommy, and Mediator Molly. The caveat, of course, is that any similarity between these characters and people in this room or outside would be purely coincidental.

Senator DASCHLE. I can see a television series already. [Laughter.]

Dr. SCHALLER. Sustainable Sam, of course, is a voice of the sustainable agriculture movement. Test Tube Tommy is that of the research system in general. I don't have puppets, so I will simply tell you who the speakers are as they change.

The conversation begins with Sustainable Sam: Tommy, I will admit that you research folks have come a long way toward responding to public interest in the sustainability of agriculture. Sustainable ag is spoken everywhere in the research system now. It shows up in your manuals and your research categories. USDA research programs like the new NRI get inputs from different user groups, including ours. You have created and used a new protocol to tell us how much research you are doing in different categories.

We are impressed by all of this, and yet we are also very uneasy. We see a lot of window dressing. What you call sustainable ag research looks a lot to us like the same old reductionist, piecemeal stuff that makes for good reading in disciplinary journals and gets scientists promoted, but doesn't have much to do with ensuring sustainability. My guess is that you still think of a lot of us as advocates of a misinformed cause, maybe even organic addicts in disguise. We still hear some of you muttering in the halls that sustainable ag is no way for the world to feed itself.

Tommy: Now, wait a minute. We have been researching sustainable ag a lot longer than you have been pushing it. Look at what we have done to boost profitable production of food and fiber in this country and how we have responded to concerns about environmental degradation and soil erosion.

Sam: Well, that is my point, Tommy. Sustainability is a lot more than getting higher and profitable corn yields with less soil erosion and ground water contamination, and you know it. You can't pick out a few of the requirements of sustainability you feel comfortable with and ignore the rest, as you have been doing all along. You have got to be looking into the connection between sustainability and who owns and operates those farms out there. In fact, you better start looking beyond the farm gate throughout the rest of the food and fiber system if you are really interested in sustainability. Sustainable ag, like most important issues, isn't just something for plant and animal scientists. You have got to get the economists, the sociologists, all of them into it in a really significant and serious way.

And another thing, you still use the old band-aid approach of doing research on ways to correct environmental and other problems after they occur, rather than studying ways to prevent the problems from occurring in the first place. You get glassy-eyed about things like biotech, but forget to ask about their possible negative impacts on people and the environment before you even get started.

Tommy: You sustainable birds are all alike. You want us to do research on how to achieve a goal or sets of goals that everyone defines differently. We just can't be going in every direction at the same time.

Sam: Well, you are right to a point, but why haven't you people, on your own, identified alternative goals to describe sustainability and then researched the question of how they can be attained? Do you always have to wait for an invitation?

Tommy: Maybe we should be acting more than reacting, but you folks seem to have your minds made up on what is needed to get a sustainable agriculture, so why bother? You are still on your kick about reducing chemical inputs and going back to hoes and hard labor.

Sam: You are wrong, but maybe we do get a little carried away at times. To be honest about it, we don't know what is the best route to sustainability in every place. We may never know, finally, because new information about better ways will keep coming in, we hope. That is why we need good research to replace the guesses and opinions with the best and latest information.

You know, Tommy, I think I have figured out what the real problem is. Your first love is to do good science, which is great. Somewhere along the line, though, you have decided that sustainable ag research can't be good science. For example, while we get kind of excited about USDA's LISA (sorry, SARE) program and on-farm research, you people still are reciting your old litany that good science can only be done on experiment station plots or in your fancy laboratories. I have got to believe that SARE and related programs are telling us that research on how to ensure sustainability really can be good scientific research. It has to be if it is going to serve its purpose well. So you have got to rethink and change your definition of good science, admitting, as a start, the value of farming systems research and on-farm studies.

Tommy: Okay, so where do we go? Where does all of this lead us.

Enter Mediator Molly for the first time: Let me jump in here. I have been listening intently to your conversation and I have three recommendations for you. Consider them.

First, stop your wrangling and bashing. A lot of scientists in USDA and the land grants want to do good research on sustainable agriculture, and people who care about the sustainability of agriculture are not antisience. Your bashing is simply bad psychology. The sustainable ag community needs to try harder to share with ag researchers everywhere a sense of ownership of the sustainability issue. See that they are honestly recognized for studying it.

Secondly, start setting and meeting goals for research, as already recommended in the GAO testimony very effectively. Surprisingly, explicit goals concerning sustainability are hard to find in the USDA or elsewhere in the research system. In the case of sustainable agriculture, the applied research goal seems to be only to get to work on it. President Kennedy set a goal for science when he vowed to put a man on the moon. Fortunately, the opportunity to do something that bold has just been hand-delivered to the ag research system or community in the form of the administration's commitment to reduce pesticide use. Go from there. As the first step, find out how we can, by the year 2000, grow our food and fiber with half or less than half of the pesticides now used.

Finally, get help. Ask a respected institution or group to help you untangle this pesky conflict between "doing the right research" and "doing research right." Get to the bottom of the interpretation that sustainable agriculture, among other important issues, does not lend itself to good scientific research. You can do it, if you just put your minds to it.

End of conversation. Thank you.

Senator DASCHLE. Well, Dr. Schaller, that was an intriguing conversation. It sounds like you lifted the hearing record from this subcommittee on a couple of occasions.

Dr. SCHALLER. I have read it.

Senator DASCHLE. Well, I like Molly; she has some good ideas.

Dr. Thayne Dutson is the Director of the ag experiment station at Oregon State University in Corvallis, Oregon. He has come a long way and I deeply appreciate his presence. He is accompanied by Dr. David Ervin, department head of Agricultural and Resource Economics at Oregon State. To both of you, thank you for being here, and we will take your testimony at this time.

STATEMENT OF THAYNE R. DUTSON, DIRECTOR, OREGON AGRICULTURAL EXPERIMENT STATION, OREGON STATE UNIVERSITY, CORVALLIS, OREGON; ACCOMPANIED BY DAVID ERVIN, HEAD OF THE DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS, OREGON STATE UNIVERSITY, CORVALLIS, OR

Dr. DUTSON. Thank you, Mr. Chairman, and good afternoon. For the record, my name is Thayne Dutson. I am Director of the Oregon Agricultural Experiment Station. My testimony today will be conceptually somewhat different from what you have heard so far this afternoon. Rather than offering a broad national perspective, I have been asked to describe briefly a data base of the research activities of the Oregon agricultural experiment station.

We developed this data base to help us describe our research program more effectively to key decisionmakers and to general audiences in the State of Oregon. We designed this data base primarily toward outcomes as best we could with the information system that we had, rather than inputs, and also designed it not so much initially, but as we got into it, to answer the question of management information systems and how can we get at information for making some of these management decisions.

I believe I was invited here today because of this new communication tool and the way we use it. It has attracted the attention of a number of my counterparts, and I think that may have been why I was asked to come here.

Our mission is similar to that of many agricultural experiment stations. Our research emphasizes economic, social, and environmental benefits. We have used a number of means to help others understand how, and how well, we fulfill that mission. We have delivered messages about our work in publications, reports, informal and formal talks, radio, television, and by other means.

Early in my tenure as the director, however, I sensed we could add reality, dimension and perspective to our story by being more systematic. A solution was not immediately apparent. With effort, one has evolved that is now working for us. I will skip the details about its evolution and instead characterize what we are now using.

Dr. Dave Ervin, as you mentioned, is here with me today. He is head of the Agricultural and Resource Economics Department at the university. It was Dave Ervin who suggested that any benefits we might wish to claim as deriving from our research should be

subjected to project-by-project professional review, and I think this is a very important point.

Although we had information about our activities available in a variety of forms, for this effort we started fresh; we essentially started over. We began by inventorying all projects, soliciting from each principal investigator his or her estimate of current and of future benefits. Mindful that our mission recognized benefits from our work that are not entirely economic, we added environmental and social contributions to those we would inventory, and this design was because our mission statement includes those three areas—economic, social, and environmental. That essentially is the mission statement of the ag experiment station.

My decision to gather comprehensive data and subject it to professional scrutiny led directly to the data base we now call Oregon Invests!. It brought some consistency to an effort that previously was both informal and anecdotal. While we would always like better estimates of the benefits, we believe they are considerably improved over some of our earlier efforts. I should point out that the economic benefits estimated for any given project pertain only to the direct benefits to the producer, or sometimes to the processor, the first-level benefits. We have not included the multiplier effect in this, for good reason.

Once our principal investigators had completed and returned our questionnaires, a team of agricultural and resource economists went to work on the information. For their share of the work, they drew from professional literature on assessing consequences of research. They examined the principal investigators' estimates of effects, compared them with external information, and otherwise completed a comprehensive and a systematic review of the inputs from these projects.

In selecting a computer software application suitable for storing and manipulating our information, we felt ease of presentation and flexibility were both critically important. Our principal purpose was to make information about our work readily available and easily understood, ideally in real-time response to a variety of questions. For our software, we chose a commercially available flat file data base that offers both a friendly working environment and versatile formatting capabilities for printed and for on-screen display.

When the data were complete, we created a "front end," a kind of on-screen personality, for our Oregon Invests! data base. It opens with a standard screen and displays a series of subsequent screens, buttons and dialog boxes that make it easy for even a naive user, and I might put myself into that category, to find information by making selections and by clicking on buttons.

This enables, for example, retrieval of information by geographic area of the State, by agricultural commodity, by environmental or social consequence, by organizational unit, and other similar categories. Finding projects relating to a particular geographic region is as simple as moving the computer's cursor to that region of an on-screen map and clicking the mouse button. We expect to add more of these friendly features to Oregon Invests! as it evolves. I have prepared a handout that illustrates some of the on-screen displays that help make this system easy to use, and some of you may

have that.¹ I also have the computer system here where I can give you a demonstration of that, if you so wish, when I finish my written testimony.

For those of us who first became acquainted with data bases on main frame computers, Oregon Invests! gives new meaning to the word "personal" in the personal computer. A copy of the data base is on the computer in my office where I use it in discussions with research leaders, industry and government representatives, and others who sometimes meet there in my office.

Another copy travels with me in my color laptop. If the audience is more than one or two, I simply connect the laptop to a color overhead projection panel and display in larger size what otherwise would be on the computer screen. It is fast and encourages audience interaction. In addition, I have used it by hooking up to someone's monitor in their office. Sometimes, people have large 17- to 21-inch monitors, and there is a new technology coming about that you can use a regular TV and a video system where you can plug your computer right into that, which I think will be the preferred method rather than carrying around this box of stuff with me. This is fast and it encourages audience interaction, and that is something that I think has been really useful in this system; at least, it has been for me.

By now, you can see my enthusiasm for Oregon Invests!, and I view the start-up cost and the numerous hours of faculty and administrative time as having been amply returned to us. Access to information and flexibility in retrieving it helps me translate the abstract language of the experiment station mission into tangible realities and living examples that people can understand.

Our investment is returned in the form of broader insights and greater understanding among those to whom we are accountable, and I think this is important. I also sense it has helped build trust and has increased our credibility with many of the decisionmakers and many of the people who utilize our research data.

Our early experience with Oregon Invests! led us to recognize some constraints inherently in our preliminary effort. Although the data base—

Senator DASCHLE. Can I stop you for just a second, Dr. Dutson?

Dr. DUTSON. Yes.

Senator DASCHLE. You make the point that your investment is returned in the form of broader insights and greater understanding among those to whom we are accountable. To what extent are those returns on investment calculable?

Dr. DUTSON. They are quite calculable in the economic area, less calculable and less subjectively detailable in the economic and social area. There are a number of things that we think we can do to increase the usefulness of this data base. Quite frankly, we think we have only just begun to walk in this area, but the economic benefits, we think, are quite calculable.

Now, we have to be quite careful that we don't do too much aggregation. We also need to be careful that we have good data analysis before creating the data base.

¹ See pp. 23-24.

Senator DASCHLE. Can you give me an example of something that, as a result of your calculations and this investment, you are doing differently today?

Dr. DUTSON. That gets to the management information part of this. The data base was originally designed for looking at accountability, looking at the impacts, what are we getting out of what we are doing. As a result of putting this data base together, we find there is a real usefulness going to come in using this for management information.

We have not yet used this to tweak the system back in the State experiment station for making management decisions where allocations will be made, but that is one of the next steps in the Oregon Invests! data base—using this information to get back to analyzing where those impacts are and where our money is creating some of the greatest advantages.

Keep in mind we have to be very, very careful in that because much of our research is long term and has a benefit that may be 20, 30, even 40 years down the line. So if we just used the economic and even some of our calculable, on-line data right now—social and environmental benefits, we may miss funding an opportunity that would come to fruition at a later point in time. So we have to use some subjective analysis on top of the objective analysis that we have here.

So making management decisions, as I have pointed out in a paper that we have written concerning this data base, and also the Department of Ag and Resource Economics has written a paper about how this management information should be put together—this is one of the things that you have to be very careful that you don't just use it as a quick fix to management, that you use it as a part of your tool kit for managing the system. I think it is a very important tool that, in Oregon, we hadn't had before.

There are a couple of things that I would like to emphasize at the end of my testimony, and then I can show you the data base and maybe you can become a little more familiar with what we are doing.

You must be clear about what you expect and how you will judge success. I considered Oregon Invests! a success when it helped me communicate effectively with key groups to whom we are accountable. That was the first stage, that was the design of the data base initially.

View this as an information-age personal communication tool. In today's intensely dynamic world, time is precious. Information is perishable and we must compete for people's attention. No longer do our audiences always have time to read lengthy reports or publications. Instead, we must answer the questions they have, only those questions, and answer them when and where they're asked. Having such a system will create the greatest and most immediate impact.

Oregon Invests! is not a silver bullet for the challenges of accountability. Do not think of a system like this as a computer-based solution to our responsibility to be accountable. Instead, consider it a communication vehicle. Although the information is stored and accessed electronically, that is the easy part. As with any communication, the hard part was identifying our audience, deciding what

message we wanted to convey, developing the information that is the content of that message, then gaining experience in its effective delivery.

Another difficulty, at least for some organizations, is deciding to allocate or reallocate precious resources for evaluation and accountability. That takes commitment throughout the organization, particularly from the top of the organization.

Thank you, and I can demonstrate it if you wish. Dave Ervin might answer some technical questions relative to the data analysis prior to creating the data base.

[The information on Oregon Invests! follows:]

Some user-interface screens drawn from Oregon Invests!

*The research database
of the Oregon Agricultural Experiment Station*

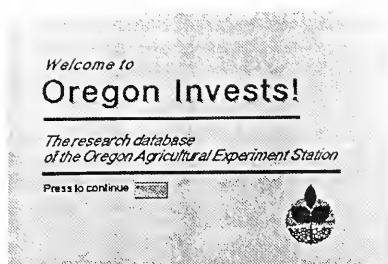


Figure 1. Opening screen

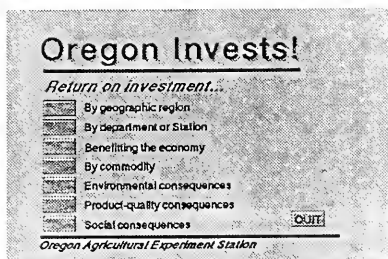


Figure 2. Selection of type of search



Figure 3. Search by geographic area



Figure 4. Search by department or unit

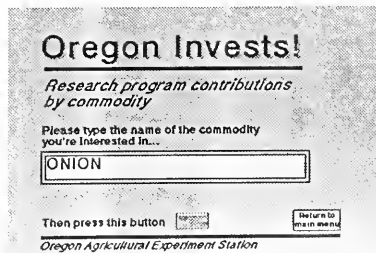


Figure 5. Search by commodity

Oregon Invests! is a database of research projects. A standard screen (Fig. 1) opens each session; clicking a button brings Fig. 2 where the user selects the kind of information he or she is seeking. "By geographic region" brings up a map of Oregon (Fig. 3) where pointing at a region and clicking retrieves summaries of projects in that area. Requesting a search by department brings up Fig. 4. Requesting a search by commodity brings up Fig. 5, in which the user types the name of the commodity of interest. These selections return project details in screens like those on the other side of this sheet.

Some user-interface screens drawn from

Oregon Invests!

Continued from other side

The research database

of the Oregon Agricultural Experiment Station

Oregon Invests!

Oregon Agricultural Experiment Station
Doreen L. Calverton

Weed Control in Nursery and Ornamental Plants

Ticknor, Robert L.
North Willamette Research & Ext Cntr

Estimated 1992 benefits to Oregon: \$3,500,000

Nursery weed control is complex with 139 herbaceous, 102 conifer, and 283 broad leaved wood species, and 140 species of cultivars produced in Oregon. Container grown nursery stock can only be weeded by hand. The research has been testing herbicides for efficacy and crop tolerance with organic media used for container production. It takes 825 hours of manual labor to weed 1 acre of stock in a 1-year cycle. Weed resistance and shifts reduce a herbicide's effectiveness over time, necessitating new herbicides to continually be developed. However, new products cost more because of increasing development and registration costs. The project is developing new herbicides to reduce herbicide costs and reduce manual labor. The project is developing new herbicides to reduce herbicide costs and reduce manual labor. The project is developing new herbicides to reduce herbicide costs and reduce manual labor.

Figure 6. Project summary emphasizing economic consequence

Oregon Invests!

Oregon Agricultural Experiment Station

Development of Regional Irrigation Requirements for the State of Oregon

Cuenca, Richard
Bioresource Engineering

Est. 1992 economic benefits to Oregon: \$800,000

Consequences of this research for the environment: Improved estimates of irrigation needs with result in optimized irrigation scheduling and a more efficient use of water. This should decrease soil erosion and runoff of farm chemicals, and improve crop yields. The information generated by this research will be used in modeling global climate change.

Give details... Next project Previous project Return to main menu

Figure 7. This project summary describes environmental consequences

Oregon Invests!

Oregon Agricultural Experiment Station
1991

Weed Control in Nursery and Ornamental Plants

Plants are generally priced by size, so larger, weed-free plants sell for as much as 50% more. Hand weeding 1 acre of container trees takes 825 hours/year at \$12.50/hour = \$10,312.50/year. If effective herbicides developed in this project cut down labor costs by 112 and also increase product value by producing weed-free, larger plants, benefits could easily amount to \$1,100,000, with total benefits reaching \$1,800 = 2,400 acres in container plants = \$2.5 million/year. Development of new herbicides will continue to be important to the nursery industry, especially container-grown stock.

Return to project

Return to main menu

Figure 8. More information, including how contributions were calculated, is delivered when "Give details..." is clicked on initial screen that describes a project.

Senator DASCHLE. How long is the demonstration?

Dr. DUTSON. I can give you a demonstration that would last 5 minutes or 2 hours.

Senator DASCHLE. Well, why don't we try the 5-minute one? If we could do that, I think it would be helpful.

Dr. DUTSON. As you notice, the data base comes up, and we thank people for being interested in it because it is their interest that brings them to this point in time. Whether I am in my office talking to some of the commodity people, whether I am in an office of a legislator or a staff member, or whether I am meeting with a group of environmentalists in Portland, many times these questions come up and the questions then get us to the use of this data base.

I have it sorted by various categories at the click of a button. One is geographic region, and I think this is one that tickles the fancy of a lot of people in the State because they can see, then, what the impacts of our projects are in that region. The next phase of this data base will fine-tune that down to the level of counties. That is more difficult. It will take more analysis, but I think it can be more useful. Then we can aggregate various counties in any kind of a system that someone would want, like they would say county 1 through 10 or 12 through 13.

Senator DASCHLE. How do you define impact in this case? I mean, it would be hard, it would seem to me, to quantify impact of a lot of either basic or applied research. How do you do it for purposes of this project?

Dr. DUTSON. Initially, the impact is calculated by the individual scientist, and then it is sent to the Department of Agriculture and Resource Economics and they put the science of economics and social science to that and there is a task force that analyzes each of those projects relative to the reality of the information that comes from the scientist.

We are now in the process of going back to the scientists and fine-tuning that, so it is an iterative process. But, essentially, I think you have to apply the most updated techniques in the science of economics, and also the social sciences, relative to analyzing the impacts.

Senator DASCHLE. How many categories of impact would you have?

Dr. DUTSON. We have international, national, statewide impact on the side, and then back to the main menu we have impact benefiting the economy, environmental consequences, social consequences, which are the three basic tenets of the mission of the agricultural experiment station, and then product quality consequences because we feel that is important as one of our management information tools, and that figures into designing this data base for management information.

We can go to individual department or individual station. Let us say, for example, we want to look at the Department of Horticulture and what the impacts are of the work that they are doing in horticulture. Here is a project by Jim Baggett that, in 1992, the estimated benefits to the State of Oregon is \$1.4 million; if we go on to this project by Ray William, \$1.3 million. So as it sorts the

data base, it puts them in descending order of economic value of that project in 1992.

We also have the ability to call up a summary of that data base sort. This data base sort will bring into the analysis both 1992, projected in 1997, and projected in 2002. If you notice, here is a project that has zero benefits in 1992; projected in 1997 is \$2 million, projected in 2002 is \$4 million. Now, these may or may not come about, but in looking back at some of our previous projects, that analysis at least is in the ball park.

So it tells us, looking ahead, as to what we think the payoff of that project is. During the State legislative session, I had some people ask me on specific projects, if you had to cut out those projects, what would be the effect, and we were able to come back to this analysis and give them some information, although not scientifically exact, but at least it gets into the ball park, and better than we would have had otherwise. We can run a printout of this or we can run a printout of each individual project.

If we look at it by commodity, we can do it not only by specific commodities, but we can in this data base sort the information by key words in each of these segments. So we can put "environment" or we can put "soil" or we can put "streams." Now, in horticulture, I don't know whether there might be any in streams. However, this will sort for streams anywhere within the data base and we will find out how many projects. I can tell you by clicking on this button here. There is only one project in here that has streams listed as one of the items in there. Now, I know there are a lot of other projects that relate to streams and stream flow, but in the data base they didn't include in the "streams" write-up.

If we go back to the data base and look at "water," for example, this has sorted out some 25 projects that have water as a major component in the write-up, so not only can we sort by specific commodities like wheat and beef and various other items. This data base then sorts those that have water as a major component of the write-up. Then we can sort this in and actually print those out. So we can look at the benefits and we can print out individual projects or we can print out the total projects.

Now, the project system right now is designed to be sorted primarily by economic, and then the social and environmental come in after that. So our primary sort mechanism right now is economic. Now, if you notice up here, Watershed Research on Oregon's Rangelands, \$5 million to the State's economy, \$7.5 million projected in 1997, and 2002, a projected \$10 million. This is a real critical for the State of Oregon and for the Northwest and the entire West, as you are well aware.

Senator DASCHLE. How much disagreement do you find as you project value? I would think that that would be not only contentious, but even political.

Dr. DUTSON. It is contentious, and probably both contentious and political, but sometimes those are synonymous as well. The system that we use for analysis in the Department—I could have Dave Ervin maybe speak to that. There is some controversy, and there also is some controversy within the Department as to exactly where that is. So keep in mind that you can't tally these all up, and any

\$500 difference, you make accurate management decisions. You are essentially getting into the ball park.

Maybe as we get more used to this kind of a system, we can do a better job of analyzing those specifically. The science of economics is now progressing in that area and I think they are getting better at doing this, but Dave might be able to help with that.

Dr. ERVIN. You are very right. It is contentious. Basically, we have to make the best estimates that we can based on subjective probabilities because the effects or the consequences of the research have not yet been manifested. So we take the best information we can get our hands on and try and examine that and look for realism in terms of its magnitude in relation to the industry, the costs, whatever the yields may be, and make our best estimates.

But we are in an area of extreme uncertainty. I think Dr. Dutson is right. Most of the research evaluations in the past, in fact, have looked backward, and this one looks forward. That is a major difference.

Senator DASCHLE. What degree of acceptance have you found in the research community to this?

Dr. ERVIN. We haven't yet pushed it through the research community. In Oregon, it has been very useful. We are in the process of writing papers and putting it into the research community. We haven't done it yet.

Senator DASCHLE. But you have no idea what the research community might say about this?

Dr. ERVIN. We used existing economic theory and methods that are well-substantiated and founded in order to make these estimates, so we are on very firm ground there. The difficulty, as Dr. Dutson said, is that we are looking forward and there is always uncertainty when you are looking forward. So many of our estimates depend upon the accuracy of those forward-looking consequences. We as economists can't necessarily predict what a new yield variety is going to do. We have to try and examine that with the investigator as best we can.

Senator DASCHLE. I am going to ask Mr. Robinson and Dr. Plowman for their reaction in a minute when you are finished, but please proceed.

Dr. DUTSON. If we could move now to environmental consequences, it will take a little while for this to sort out because it moves into a different portion of the data base. Keep in mind that as we pull up the environmental consequences, it still sorts it by economic, so some of the environmental consequences have positive economic consequences. We also have found some that might have some negative ones. Also, as you look at some of the projects, we have found and documented some negative environmental consequences. Quite frankly, though, I am happy to see that there are as many positive ones as there are and as few negative ones as there are. But there, again, we are just in the process of getting to a good analysis here.

Now, if we look at the 5- and 10-year dollar impact, we click on that and find that this project had no economic value or projected value. However, there was a major value environmentally. Each of these projects, then, we can come to and see whether or not they have any dollar value, and the major ones that come out in the eco-

conomic, at least the first ones in the sort that have the major economic value, don't have the economic values because that essentially wasn't one of the primary analyses.

But if you look here, there are some that do. Here is one that had zero in 1992, but it is projected to have \$1.6 million in 1997. Others, like I said, are zeroes all the way across either because that couldn't be analyzed or because there was no effect. So you can see the opportunity to manipulate the data base relative to the specific question at hand for the person or group who is asking that question.

Now, quite frankly, the data base isn't as complete as we would like to see it and, as I said before, I think we are just learning how to walk in this area. I will have to admit that there was a certain amount of nervousness in the Department as I pushed for this kind of analysis because some of them were pushing their understanding of the science considerably in areas that they hadn't previously been comfortable with. But I will have to hand it to the Department for coming to the task and really doing the best job that they could with this, and I think we have got a real solid system because we analyzed it scientifically as best we could before we ever got to putting the front end on it. If you have got a front end on something that doesn't have anything good behind it, it looks good, but the actual information you get out of it is not as useful.

Senator DASCHLE. Well, thank you, Dr. Dutson. Let me just have you address one concern that has come to mind as you have done this. You have used the word "subjective" frequently, and you have also used the word "manipulate" frequently. You combine "subjective" and "manipulate" and you begin to appreciate what could be an extraordinary destructive power in the research community if it were in the wrong hands. What kind of protection is there as you go through all of this?

Dr. DUTSON. As we put together the paper relative to how we think this kind of a data base should be used, at least for the quality and the system that we have here, it has to be used very carefully and be used by a person like myself who really understands the projects very well and understands the system.

Intuitively, we as research managers, I think, have known that many of the projects were creating impacts, and we knew that we weren't just dumping money down a rat hole because we understood the outcomes of that project. The problem is we didn't have a way of quantifying those outputs. This is an attempt at quantifying those outputs. So you still have to have that understanding of the system, understanding of the relationship of one project to the other, understanding of the relationship of a project that is long term versus short term. Some of these projects have been ongoing for quite some time and now are just beginning to reap some of the benefits both economically and environmentally.

Senator DASCHLE. Yes, Dr. Ervin?

Dr. ERVIN. May I add to that?

Senator DASCHLE. Sure.

Dr. ERVIN. I think you have put your finger on an important point, and it could be, in fact, in the wrong hands, a very dangerous information base. It has to be treated with great care and you have to know how it was constructed and what its intent is.

It is not to be added up because even though the title suggests so, this is not a data base to compute the rate of return on investment. For that, you really want a social rate of return that includes environmental and social factors, that at this point we cannot quantify and reliably estimate.

This is an attempt to try and look forward with impacts, not to estimate a finely-tuned rate of return.

Senator DASCHLE. Well, let me just applaud you for your innovation and for coming up with a prototype here that certainly merits careful consideration. In fact, it may be that we invite you to come back from time to time to give us periodic updates.

Dr. DUTSON. Hopefully, it doesn't include too many red-eyes. [Laughter.]

Senator DASCHLE. That is right, but I am anxious to see how this develops and how it is integrated into the system in Oregon. The GAO has made it very clear, and I couldn't agree more aggressively than I have in the past about the lack of a really good opportunity for evaluation and constructive consideration of our research investment. I noted with some interest on their last chart, "factors inhibiting a shift in priorities is lack of a management information system." It is something we have talked about in this subcommittee before, and I, for one, am going to be pursuing ways to acquire that system and you have given us some ideas here.

Mr. Robinson, is this what you had in mind?

Mr. ROBINSON. Obviously, this is a very impressive package. In our view, anything that moves us away from assessing research by counting and classifying what is being done, and shifts the focus to what is being accomplished or what the impact is, is movement in the correct direction.

I think we would add one more element to that, if we had those measurable objectives and measurable goals in place, as called for in S. 20, the recently passed piece of legislation, I think you have an element that, combined with this, you are really in a good position to say, yes, we are getting what we want out of this multibillion-dollar research effort or, no, we are not.

Senator DASCHLE. Well, you made a point earlier that I noted with interest. You said we have to be able to measure output, in addition to input, and put more emphasis on output measurement. What you are suggesting is an objective set of criteria by which we examine just output, and that was getting to my earlier concern expressed about subjective evaluation and data understandably manipulated to fit a computer model. But if you had goals delineated by which to associate output, you would be in a better position to objectively examine your success.

Dr. DUTSON. I think, also, if you could use something like this in conjunction with looking at your input data, we have a pretty good input data system as to where the inputs are going, or at least the amount of effort that you have by man-year, commodity areas, that sort of thing. So if you can combine some of this on top of that, that information is useful for what it was designed for, but I think we need something in addition to that to put on the back end of it. So using both of those pieces of information, plus your understanding of the system—and that is why there needs to be some subjective management. That is why we are hired, I think,

as managers of research systems, is to do some of that. But, quite frankly, I felt I needed more tools to help do that.

Senator DASCHLE. Dr. Plowman, what do you think?

Dr. PLOWMAN. Well, Mr. Chairman, you know, we just recently in 1993 passed a Government Performance and Results Act which is going to require that all Federal agencies develop some systems to have performance goals and be able to measure those things. So I think we should be very busy in looking at all the possible models to help us do that, and this is one of them that we will be very interested in looking at.

Senator DASCHLE. Had you had an opportunity to see that before?

Dr. PLOWMAN. I haven't, no.

Senator DASCHLE. I hadn't either.

Dr. DUTSON. This is brand new. It has only been used at home just this year in our legislative session, as well as just post-legislative session with some of our commodity groups, so it is brand new. We have been working on it for—I guess, Dave, you came in, what, 2 years ago?

Dr. ERVIN. Yes.

Dr. DUTSON. I had some progress made on it before then, so I have been working on this idea for over 5 years. Getting it to this point in the last 2 years has been fairly hard work getting to this point, and there again I think we have a lot of room to advance this concept.

Senator DASCHLE. As Mr. Robinson has indicated, it is a very impressive beginning and I applaud you for it.

Dr. Schaller, what would Sustainable Sam say about this? [Laughter.]

Dr. SCHALLER. Sustainable Sam would be greatly encouraged, I think, because it gets to the point that has come up here several times that we do a much better job, usually, of talking more about inputs to research than about outputs. Production researchers may be more familiar with output kinds of goals than other researchers. I venture that a lot of scientists sit around and wonder how to achieve 250-bushel corn and so forth. That's an output goal. It is much harder to specify outputs when you talk about things like sustainable agriculture.

My interest in this, Dr. Dutson, would be that while there is great value in trying to put dollar signs on some of these outputs, you also have some impacts that just don't lend themselves to that. I think Dave Ervin and his department in Oregon would probably agree that there are things you can do to get at these effects.

For example, what are the impacts on family farming? Is research going to increase the pressure for or against family farming in some respect, and is that good or bad? You are not going to ask folks to say it is good or bad, but maybe they can come up with some indicators that would be extremely useful. I think this is a very encouraging activity.

Senator DASCHLE. Isn't one of the impact elements the social impact?

Dr. DUTSON. Yes. We have the three major areas that we attempted to look at, and that was economic, social and environmental. Then we tacked on to that as more of a management piece

the product quality aspect which we are beginning to take a look at.

Senator DASCHLE. I think Dr. Schaller's point about family farms is right on target, and I would hope that the social impact questions might get to that point.

Dr. DUTSON. In addition to the family farm, we are looking at rural viability and some of the projects that look at rural viability, which is more than just the family farm. It is the rural infrastructure. This analysis may show us where we need to put some more infrastructure into the rural system, such as, for example, increasing communication capability, which then will add to the impact of some of these projects because then the rural infrastructure will be able to handle it better. That is the kind of social impact things that we are looking for.

Senator DASCHLE. Dr. Plowman, let me begin a couple of the questions I was hoping to raise at this hearing by referring again to the GAO set of factors that they believe inhibit the shift in priorities. First of all, I don't know if you recall the items on the chart, but it was lack of a Department-wide research agenda, lack of a management information system, specialization in the research community, and congressional earmarking of funds. I can certainly attest to congressional earmarking, but I would be interested in your reaction to the other three.

Dr. PLOWMAN. Well, I will try to keep myself out of trouble with the answer to that, but you have already taken care of the bottom one, so I won't have to do that. On the specialization in the research community, that is a factor, there is no question about it. You not only have scientists trained in certain ways, but you have locations with facilities, and so on, and you usually have a big investment in those two things and it is difficult to say, well, we don't need these scientists or these facilities or equipment, and so forth, anymore. So you make some—

Senator DASCHLE. So the infrastructure drives the priorities to a certain extent?

Dr. PLOWMAN. Well, I wouldn't say it drives it, but it certainly influences it. What we end up doing, generally, is change the emphasis of things within that category, and that reflects on some of these other charts. For example, one of the charts shows that there has not been very much shift between animals and plants, and so on, but there has been a great deal of shift in the kind of work done within each one of those. So I think that certainly should be noted.

Senator DASCHLE. I was going to raise that issue myself and almost conclude the opposite. I look at ARS objectives, which would be a breakdown, I would think, to a certain extent, and you have got almost identical percentages in a decade from 1982 to 1991 in plant and animal productivity, you know, as opposed to soil, air and water, commodity diversion, human nutrition, and all of the other options there.

Frankly, I am not sure these options are adequate, and there ought to be additional options. We shouldn't be locked in necessarily to the ones that we have in color here, but for good reason this chart depicts it that way because that is where the money is.

So can you elaborate? I am not sure I agree with that, given what the charts seem to show.

Dr. PLOWMAN. Well, I would say that the chart is essentially correct in that if you take just those categories there has not been a whole lot of shift in the percentage of work going on in plant science and animal science. But if you take the area of plant science, for example, there has been a great deal of shift in the kind of work done in the area of plant science.

For example, as compared with 5, 6, 10 years ago, there is much more emphasis on the environmental aspects of producing plants. For example, all the entomology work is included in there. All of our work on plant breeding for resistance to insects is all included in there, emphasis on new insect pests, like the sweet potato white fly and the Russian wheat aphid and things like that. So there has been a big shift in the kind of work done within plant science.

Senator DASCHLE. It reminds of the conversation that Sam and Tommy were having about cosmetics or substantive change. Can you shed any light on that, Mr. Robinson?

Mr. ROBINSON. I think this discussion is very instructive and it proves the point we were trying to make earlier that it is relatively fruitless to sit and discuss what category some particular effort should be put in or not put in. The only true way to measure whether you are getting what you want done as a congressional policymaker is to have some measurable objectives out there, and measure how well we have accomplished those, not get into a prolonged debate as to how we classify one project or another.

Senator DASCHLE. Well, I agree with that, but how do you respond, then, to the problem that I have today, which is, short of having those objectives in place and short of having the Oregon system as a national system, or something like it, to judge output objectively, our only other option is to look at inputs and come to some conclusion about priorities. I mean, I think in the short term we are almost constrained to do that. Would you not agree?

Mr. ROBINSON. I guess if that is the case, I would call you virtually blind. I just don't see how this tells you very much, and I guess I wouldn't concede defeat on shifting the system. We would encourage the Congress to work closely with the Department to come up with these measurable objectives. While it obviously can't be done on the back of an envelope, I think a concerted effort could produce these things in a very short period of time, especially since, as Dr. Plowman has pointed out, S. 20 requires this very action. I think with that in place, everyone is a whole lot better off—the USDA, you, everyone.

Senator DASCHLE. Does anybody else wish to comment on that? Dr. Dutson?

Dr. DUTSON. I think the system has taken some steps. I am co-chair of a committee that is a joint ESCOP, which is the experiment committee on policy, and CSRS Committee on Communications. Through some monies invested through CSRS and some monies invested through the experiment stations with some of our personnel, we have begun to look at and have granted to both North Carolina State University and Rutgers University the first look at a national data base system.

I think it is going to be somewhat different than this, and I think there may be some real opportunities here to combine State systems like I have with a national system which might have some commonalities. Keep in mind, I think each system needs to be designed individually for the best use of where it is going to be used, but if we can create some commonalities, then we can have common data fields that might be in both a State and a national system, and those common segments of data base then can be manipulated and calculated to be useful for the specific purpose at hand. So I think there are some initiatives being taken, and how fast they will go depends on how much we invest in them.

Senator DASCHLE. Go ahead.

Dr. NIPP. Just a real quick comment. I think Dr. Dutson is probably a little bit too shy to say, but there has been a great deal of interest in his program through the whole State system and a great deal of attention is being paid to it. As he suggested, through these committee activities there is a great deal of interest in figuring out how we do this and how we get there from here.

But I would like to ask a question because I think it would help our community understand how we are going about the business of doing that, and that is if Dr. Robinson could explain what these measurable objectives are, because we can imagine some. I can imagine something like reducing nitrate loading into ground water aquifers in the following areas by 20 percent by the year 2000. I understand what that is and I understand how you measure it to get there.

But what are you referring to when you talk about that, and how do you propose, as a system nationally, we define what that series of definable objectives would be? I am not against the idea at all. I think it is a superb idea. I am just trying to make sure I understand the discussion.

Mr. ROBINSON. First of all, you have advanced my academic credentials a couple of levels. [Laughter.]

Mr. ROBINSON. Arriving at specifics is fairly difficult to do and it obviously would involve a long process of negotiations, but the type of thing, I think, that Dr. Schaller was talking about where you say—look, we want to achieve a 50-percent reduction in the amount of pesticides flowing into our ground water and our rivers by the year 2000. I mean, that is something tangible and relatively measurable.

Again, I hate to get specific because it tends to distract people from the main point. I am just trying to be illustrative of the kind of case we are talking about.

Senator DASCHLE. Just speaking personally, I want to see more balance between basic and applied research. I mean, it is a 90–10 split today. That is blasphemy, I think, for Mr. Robinson because it talks again about input, but I would like to see more applied research output and I don't know how to quantify how much I want to see. I just don't think the balance that we have today is a very valid one, given our needs and given the opportunities that are there in agriculture to take research and apply what we know we can do in agriculture to a lot of other problems out there. Fuel is just one example.

Yes, Dr. Schaller?

Dr. SCHALLER. It seems to me that long before the Oregon system goes nationwide, there could be a lot of educational value in just this kind of discussion among people in the research community as to how to connect these things. I believe that scientists can be encouraged to think "impacts," and this system could have an educational value along that line.

It is not going to change all of the categories around. It is not going to deal with the problem, Senator, that you have spoken of, but just getting them to think about impacts will help. Our problem is that all of a sudden researchers halfway through the research say, "Oh, I hadn't thought about this or that impact." We would make a lot of progress just working at that.

Mr. ROBINSON. Mr. Chairman, if I might just speak anecdotally for just a second?

Senator DASCHLE. Yes, please.

Mr. ROBINSON. In our world, the GAO world, when requests come in from chairmen asking us to look at the effectiveness of research initiatives or research projects, I tell you the instant reaction of the staff involved is, oh, no, how am I ever going to evaluate this; how can I tell whether something was effective or not effective. I think this is the same dilemma that you face. How can you tell whether something is effective or ineffective without measurable goals.

Senator DASCHLE. That is right. Yes, Ms. Roy?

Ms. ROY. Mr. Chairman, I might add that your problem about basic and applied research wouldn't be as much of a problem with measurable goals. I mean, they are going to have to do applied research to achieve measurable goals, specific goals like the kind Dr. Nipp and Dr. Schaller mentioned. The argument will work itself out, I think.

Senator DASCHLE. I think you are right. That goes to another question I was going to ask Dr. Plowman. In your answer to us—and, again, I want to thank you. I thought the comprehensiveness of your answers was very helpful. You said you take a bottom-up approach in developing priorities, and I think I know what you are referring to there, but what I don't understand is how in that bottom-up process you come to any kind of shakedown, any kind of determination as to priorities.

It sounds to me like it is sort of a free-for-all, and it concerns me that the internal dynamics are affected to a large extent by internal bureaucratic politics and not by the scientific criteria that we are talking about here. Because we don't know the outcome goals and there seems to be a good deal of latitude in how these priorities are established internally, the whole process is so amorphous. Can you shed some light on that?

Dr. PLOWMAN. Well, I will give you a little philosophy that I would like to see us move toward that answers a lot of these things. I think our whole research agenda ought to be focused on the problems that we collectively think we have in society and in agriculture, and it shouldn't be too difficult to decide what the most important, big problems are. I think we can do that and get pretty good consensus.

Now, once we decide that, where we have a lot of problem is when we start evaluating individual little projects and see how

they contribute to solutions. It is easy to take one project and say, well, that is basic science, we don't see where that is going to answer this big project. But I think we ought to quit talking about basic and applied science. We ought to talk about the solution to problems and the kind of science that we need, or the technology we need to solve those problems.

If we have an insect out here and the only thing we need is a fly swatter, a new design of fly swatter that is a little more effective than what we have now, everybody would agree that is an applied problem and we can develop a fly swatter.

If you go back in history to the screwworm eradication program, we were spraying screwworms in the southern part of the United States and it wasn't getting us anywhere. We had a terrible loss in livestock. It was expensive rounding them up and spraying all the time, and it wasn't doing anything to solve the problem. So we had some people that decided we needed some new technology to solve the screwworm problem, and there were some very, very basic concepts that had to be worked out to do that.

So we ought to say to ourselves, what is the technology that we need to solve this problem, whatever that is, and it might be very, very fundamental that gets us to it. But we should always be working directly on the problem.

Then the other thing is we need to make sure that we have a reward system so that scientists want to do that and they are fairly evaluated and promoted and given tenure and whatever. If we could do those two things together, if we could change our reward system a little bit and we could focus on the technology we need to solve the big problems, I think that we would move down the line a lot faster. If we did that, too, I think we could then have these measurements of success, or these goals that we are shooting for. But that is going to take some doing to get all that, including the cooperation with the Congress to get it done.

Senator DASCHLE. Well, I agree with you. I think we have a golden opportunity here with the reinventing government movement. We have a markup in a couple of weeks and I hope it is really just the first in a series of efforts to reorganize because, obviously, from your answer to my earlier question about when you would be ready to give us some guidance on advisory committees, you said 3 months. It would be great if we could get some guidance in 2 weeks.

Dr. PLOWMAN. One of the little problems we have is that everything we do, someone feels like they have ownership to it. It is a constituency for whatever, whether we are talking about a single research project or clear up on the other end, just an advisory committee. If you are dealing with relatively stable budgets, which we have if you take into account inflation, if we change priorities a whole lot, it means taking something away from somebody and giving it to somebody else. Since someone already feels like they own it, it is very, very difficult to do that.

We have the same problem whether we are talking about discontinuing an advisory committee or changing a research project or a location, or whatever. We need to think together between us and the Congress about how we can overcome some of those things.

Senator DASCHLE. Let me ask you about another thing you mentioned in your answers to my questions in August. You said that SCS does an annual review of its research in concert with ARS and the experiment stations, but what you didn't describe, at least in my ability to understand, is how that then becomes integrated into some prioritization.

I mean, here you have an outreach effort and assessment effort going on out in the field, but there seems to be sort of a bifurcation between that and an integration of whatever it is they are doing in the priority setting here in town. How does that work?

Dr. PLOWMAN. Well, one way it works is in the budgeting process in the Department, once a year all of the actors have to develop budget proposals not only for new funds, but to justify the areas that they are working in now.

Senator DASCHLE. At what point does CSRS, for example, here in Washington sit down with whatever data you have acquired to say, all right, based upon our assessment of the way things are working, this integrated plan is going to be part of our priority setting for the coming year or the coming many years?

Dr. PLOWMAN. Boy, that is such a difficult problem. Dr. Nipp mentioned some of the things that we all need to recognize. It is like the golden rule, you know; he who has the gold rules. Now, the Federal Government cannot tell the States how to spend their money, and what we are doing in the Federal sector is giving the States, what, 20 percent—I think someone said today about 20 percent of the money that they use in agricultural research.

So Dr. Dutson is going to take that 20 percent, plus the 80 percent that he has from other sources, and he is going to do the most important things for Oregon, plus he is going to, to the best of his ability, have that be in concert with the national priorities, and so on. I think that is right. Dr. Dutson, is that correct?

Dr. DUTSON. Yes.

Dr. PLOWMAN. But we can't sit here in Washington and tell him how to spend that 80 percent, and so we have a very diverse system out here that no one has very much control over. It is controlled by 50 State experiment station directors, plus the Feds, and so if anyone thinks that you can achieve a high degree of coordination, well, you are just kidding yourself because that is just not how it is going to work. It just doesn't work that way.

Senator DASCHLE. I think you are right. I don't think anyone would argue for the Federal hand of regulators to be out there telling these experiment stations what to do. I am worried about what Washington is doing. My concern is that there isn't any coordination here in Washington.

Dr. PLOWMAN. Well, there is. Let me just direct a question to Dr. Dutson that may help to explain that.

Senator DASCHLE. Okay.

Dr. PLOWMAN. ARS has a laboratory on his campus and that laboratory is part of a national Federal activity, but he takes some ownership to that because it contributes directly and is tightly integrated with his objectives in Oregon. Now, I haven't asked him or even looked at him, but I am going to now and ask him if that is true. Is that true?

Dr. DUTSON. Yes, that is true. In fact, we have not only the national germplasm laboratory there in Corvallis, but we also have the ARS seed laboratory and we also have the ARS horticultural laboratory, and we have many joint projects with those ARS scientists who are located there.

I think some of what Terry said gives us a little bit of a mechanism for aggregating what are the State priorities because the State priorities collectively are essentially, or should be, national priorities. So we are attempting to aggregate those State priorities into national priorities. I have been involved in that in the first quadrennial update and I was co-chair of the workshop in Texas, and I think we did a much better job of getting input, particular customer input, this time than we did before. So we are getting better with that.

Dr. PLOWMAN. And just to add to that, ARS scientists were also part of the workshops that developed the priorities with the States. It was a joint effort.

Dr. DUTSON. So there is quite a bit of coordination within the system and I think the priority setting—in fact, ARS, as they put their priority document together, is not blind for what comes out of the State system, and vice versa, because we try to work together. So I think there is maybe a little bit more than might be on the surface, a coordination with that, aggregating the State and local priorities into the national priorities.

But I think we have some real opportunities here to fine-tune that and come with some more quantifiable objectives in that. Essentially, we have been looking at, you know, what are the research priority areas. Maybe we need to be bold and take another step and put together some quantifiable objectives on that. It is a little bit scary, but maybe we ought to do that.

Senator DASCHLE. Mr. Robinson, how much does specialization inhibit prioritization?

Mr. ROBINSON. You mean the shifting of priorities or prioritization, in general?

Senator DASCHLE. I guess I would say shifting of priorities primarily, but also just prioritization in general. The impression I have is that there is a tremendous amount of specialization in the system and to a certain extent it is a major inhibiting factor, but I would be interested in your observation.

Mr. ROBINSON. I think Dr. Nipp put it very well. There is a very substantial investment in the status quo—long experience, a lot of dollars in facilities. The incentive in that structure is to pretty much stay on the current track, especially if there is no real incentive to change. While changed priorities can be set at the highest level, if the dollars keep flowing and you get to keep doing what you were doing to begin with, although sometimes you may have to call it something different, there is no reason to change. That is, it seems to me, a prescription for an orientation to the status quo.

Senator DASCHLE. That is certainly my perception. Does anybody dispute that?

[No response.]

Senator DASCHLE. The record will note no response.

Yes?

Mr. CARLSON. I would like to ask Dr. Kelman, our chief scientist, to comment on that if he could.

Senator DASCHLE. Okay.

Mr. CARLSON. He has just finished his term the last 2 years.

Senator DASCHLE. Sure. Please identify yourself for the record.

Dr. KELMAN. Thank you. My name is Arthur Kelman. I am emeritus chief scientist as of a few days ago. I think it would be interesting—I can't give you the exact figures, but to look at—one of the areas to reduce pesticides is biological control systems. Take a look at the number of scientists, the number of grants, the amount of effort going into biological control systems, which is one of our hopes for the future. There has been a tremendous shift. So when people say there is no shift in the system, that simply isn't true in these areas that we have set priorities for. I mean, it is shifting.

Senator DASCHLE. Well, you can't tell it by the pie charts and by the—

Dr. KELMAN. That is exactly right, and that is why I am happy to make the comment because the comment that was made is that you can't look at the broad categories.

Senator DASCHLE. Well, but then give us categories we can look at. That is the problem. You know, I hear this constantly that, oh, we are making all kinds of changes, but I get the same data every time we hold one of these hearings that confirm virtually what I have feared, which is that we are just continuing with the status quo.

Somebody needs to come to this subcommittee some time and give me some data in black and white or multicolor—it doesn't matter—that show me that there are some fundamental changes in what we are seeing in research today. For the life of me, when the GAO comes with an extraordinarily impressive and authoritative report that says we are doing basically the same thing today as we did in 1982, recognizing Mr. Robinson's point that all we are doing is judging input here—and that is blind, but that is all I have to look at right now until we get the output, and I am going to get into output here in just a second—then I think we have got a problem.

Dr. KELMAN. I think what I was concerned about with this very nicely organized presentation was exactly what you concluded—that there wasn't any change, and I am trying to say there is, and if you fail to see that, then I think that data is available and we can present it. It is available.

Senator DASCHLE. Why didn't you give it to the GAO if it is available?

Mr. ROBINSON. Well, let me say Dr. Plowman has been very kind and very restrained here. He finds fault with our numbers. Now, our numbers are based on what we were given to believe was the best set of data available for looking at the classification of research projects, and that is the CRIS system.

Dr. Plowman, and perhaps others, are not convinced that that is the best source of data, or perhaps even that we have added the numbers up right. Given that disagreement, I think we still come back to the point that it doesn't make any difference what anyone comes in here with and says, look how much we have changed, we

are doing all of these new projects and we have classified them all this way and here is what it is.

It is simply not very fruitful, and I don't see how it is very instructive, to sit here and measure change in priorities based on what you are doing and how you are classifying what you are doing. The only real substantive proof of the pudding is what was accomplished. Here are some things that we set out to accomplish, they are different from the things we set out to accomplish before, and here is our progress in achieving them.

Senator DASCHLE. Well, I think we will have to agree to disagree, Mr. Robinson, because I must say I think you are right. That is a far more accurate approach and a far more desirable approach, but we look at budget every day and budget does reflect commitment; budget does reflect our ability to anticipate a certain degree of outcome. I mean, that is why we have big fights between those who advocate greater defense spending and those who advocate greater social spending. We expect an outcome as a result of that investment.

You know, we have fights on priorities having to do with budget every single day and, as a result, we come to some ultimate decision and we commit ourselves to those resources and, hopefully, through oversight and other things, evaluate the degree to which that investment has paid off in any of these areas. So I don't think you can minimize the degree to which investment has something to do with prioritization, and I don't think you are doing it, but I think you are minimizing it to the extent that I have to disagree. I think that prioritization is a function of investment, and that is really what we are talking about here.

Mr. ROBINSON. I have certainly played the record often enough—it is probably time to quit playing it.

Dr. PLOWMAN. Well, if I might, Mr. Chairman, with the question that was asked, they put the figures together right, but it is the wrong question. The question that you just asked about what shifts we have made—the important shifts we have made are all within those blocks, and that is what we haven't portrayed. They didn't ask and didn't try to do it, but that is the thing that we need to do and you asked it.

Now, I can respond to that and I would like to have an opportunity to show you some things because we do have that kind of information and we can show you.

Senator DASCHLE. Well, if you can show me, I am going to keep the hearing record open to put it in the hearing record at this juncture, and then perhaps we can discuss this at some length in my office because I would really like to follow up on it.²

Dr. PLOWMAN. Well, I would really appreciate that because it would not be a fair characterization to go out of here and say the research system hasn't made some rather dramatic shifts and changes over the last 10 years, whether the Feds or the States.

Senator DASCHLE. All I ask is for some documentation to that effect. I won't argue with you, but I have to see some facts here.

Dr. PLOWMAN. That is right. That will be our challenge.

² See page 67.

Senator DASCHLE. We talked about guidelines last fall and you said that you didn't feel that they had been adequately articulated, and so you wanted to come back and, for the record, provide more clearly defined guidelines. I was, frankly, surprised and really disappointed with the sort of generic and very vague statements of purpose that you provided having to do with CSRS and ARS. Why is that such a problem, Dr. Plowman?

Dr. PLOWMAN. Well, maybe we didn't articulate what we have done on the purposes to emphasize and really, truly characterize the change that has taken place in the last couple of years. If I might just ask Dr. Finney to make just a comment on that, and also Bill Carlson from CSRS, maybe that will clarify it a bit.

Senator DASCHLE. Well, I tell you, this has been the most elusive effort on the part of this subcommittee. You know, to be able to specifically and with some clarity outline exactly what our guidelines are by which to judge our activities and research goals seems to me to be so fundamental, and yet I get really just restatements of purpose, which is not the same as a guideline.

Dr. Finney, please proceed.

Dr. FINNEY. I am sorry. What is the issue now? Is the issue how do we decide how projects relate to the purposes?

Senator DASCHLE. The issue is why doesn't the Congress have specifically delineated guidelines that will, with real clarity, state the overall objectives, the mission, of the research effort at the Federal level.

Dr. FINNEY. Oh, I see. The issue is whether or not we have a mission statement for the agency? Is that one of the questions—objectives for our research programs?

Senator DASCHLE. Well, as you know, we required in the 1990 bill that you very clearly define our guidelines, the guidelines by which we will judge outcomes. Really, that is what we are talking about here.

Dr. FINNEY. I see.

Senator DASCHLE. How do we make any judgment about the overall value of what it is we are doing if we don't have guidelines by which to make that judgment? Now, Mr. Robinson has spent the afternoon in a very convincing way talking about the need for specific outcomes by which to judge the value of our research. I mean, we are really talking about outcomes in a related way by talking about the guidelines. The guidelines will be the criteria by which we judge the adequacy of whatever research proposals come before you.

There are no guidelines today. There are statements of purpose, but there are no guidelines. I have never all of this time been satisfied, nor have any of my colleagues, as we envisioned guidelines to be articulated in the bill. Here it is, 1993, and we still don't have anything of that sort.

Dr. FINNEY. I see. I didn't understand that question initially, Mr. Chairman, but the one thing I wanted to emphasize to you is that we have, in fact, incorporated in our plans for the Agricultural Research Service specific guidance on the purposes that were articulated in the last Act, and we have gone through all of our research projects and identified those projects that relate to the specific purposes that were outlined in that Act.

We do require our scientists, as well as our planning staff, to evaluate all of our projects as they come in and relate those to those purposes. So that is one of the things that we have been doing to be consistent with the purposes as outlined by the Act itself.

Senator DASCHLE. Do you have those with you?

Dr. FINNEY. Yes, sir.

Senator DASCHLE. Why don't we submit those for the record?

Dr. FINNEY. I have the breakout in terms of how the programs within ARS relate to those six purposes by percentage of resources within the agency itself.³

The other thing that Dr. Plowman did mention earlier was that we do undertake efforts periodically to assess the impact of the research investments that we have undertaken on behalf of the agency, and one of those was a consultant's report that was completed last year that outlined the benefits to society from those investments and Dr. Plowman did comment on those earlier.

So those are the types of things that we have done to try to be responsive to the concerns in terms of ensuring that the investments are well made and are supportive of society's goals.

Senator DASCHLE. Well, I must say I am anxious to see these.

Dr. FINNEY. We will submit that information for the record, sir.⁴

Senator DASCHLE. It is something that we are going to revisit legislatively, I am sure, because we just don't seem to be able to come to some connection with regard to—it may be just too difficult to do to put down on paper the guidelines by which you will judge our research activities and assess those activities as to ultimate outcome.

Dr. FINNEY. The other question—would that not be the types of things that are envisioned in S. 20, the bill that was passed, where we would have specific objectives and the outcomes, and the investments would be measured on how they relate to those objectives?

Senator DASCHLE. That is right.

Dr. FINNEY. So that is a process that we are undertaking, but we don't have those performance guidelines in place, but we can assure you that we will be putting those in place for the committee.

Senator DASCHLE. Very good. Well, we are quickly running out of time, and I thank all of my witnesses for their participation this afternoon and all of your input. You have come a long distance in some cases and I appreciate that. As always, I enjoy these hearings immensely and appreciate very much the contribution made by all of our witnesses. Thank you.

The hearing stands adjourned.

[Whereupon, at 5:07 p.m., the subcommittee was adjourned, subject to the call of the Chair.]

³ See page 70.

⁴ Retained in committee file.

A P P E N D I X

PREPARED STATEMENTS

DR. R. DEAN PLOWMAN

Mr. Chairman and members of the subcommittee, I appreciate the opportunity to participate in this dialog on research priorities and the implementation of programs addressing those priorities. I am accompanied today by Dr. E.E. Finney, Acting Administrator, Agricultural Research Service (ARS) and Robert Carlson, Cooperative State Research Service (CSRS).

In the future when we appear before your committee, Mr. Chairman, it has been proposed that we will be identified as members of the Agricultural Research and Education Service. The planning of research agendas and program objectives for USDA currently represents a coordinated effort, and we see the new Service as only enhancing that activity. Based on discussion with your staff, my comments do not include the research activities of the Forest Service.

USDA research priorities and program objectives are based in part on recommendations from many sources; among them, the administration, the Congress, commodity organizations, user groups, consumers, scientists, advisory committees, action and regulatory agencies of the Department, and needs expressed by other executive departments. The range of research needed to address agricultural concerns requires that research be focused on issue-oriented basic and applied research efforts. These efforts are closely coordinated and complemented by technology transfer activities to avoid duplication and to maximize transfer of research results to appropriate users. In recent years, a continuing shift in research emphasis has occurred so that research studies now include environmental, social, and economic concerns affected by agricultural production.

Individual agencies have published long- and short-term strategic plans that reflect Department policies and goals. These plans, which are based on inputs from the science community and external customers, serve to guide the implementation of research that addresses priorities in a complementary—not duplicative—fashion. The Department's Office of Budget and Program Analysis works to assure that annual Agency budget requests are complementary and coordinated.

Agricultural research is a multidimensional program involving scientists and engineers from both the public and private sectors. This research is concentrated in the ARS and the CSRS and involves the activities of several Department agencies, the State agricultural experiment stations, and working partnerships with other executive departments.

ARS is the in-house research arm of the Department. The ARS mission is to develop new knowledge and technology needed to solve technical agricultural problems of broad scope and high national priority in order to ensure adequate production of high-quality food and agricultural products to meet the nutritional needs of the American consumer, to sustain a viable food and agricultural economy, and to maintain a quality environment and natural resource base.

CSRS coordinates and administers a large number of research projects as part of directed research such as Hatch, as well as other, formula funds and regional research. Projects submitted from State agricultural experiment stations are reviewed and approved by CSRS scientists, and proposals submitted from regional research

committees are reviewed by the National Committee of Nine. CSRS supports the administration's policy of funding research through a competitive process. CSRS also provides an avenue for our Nation's scientists to address future needs via two other grant options: the National Research Initiative Competitive Grants Program and Special Research Grants.

The National Research Initiative Competitive Grants Program (NRICGP) has a unique responsibility as the Federal sector's primary competitive grants program devoted to agricultural research. The NRICGP supports research in most areas of agriculture including natural resources and the environment and rural development. It has solicited advice from the public and private sectors for the purpose of establishing research priorities and program goals.

Several avenues have been, and continue to be, used to ensure coordination and planning between the NRICGP and other USDA agencies occurs. USDA scientists and administrators (representing ARS, CSRS, Economic Research Service, Extension Service, and Forest Service) were an integral part of the initial Research Planning Committees used by the NRICGP to develop its first Request for Proposals (RFP). These groups continue to be included in planning to modify existing programs or to establish new ones. Multidisciplinary research is encouraged, and fundamental or mission-linked research is required.

Advice from stakeholders has been solicited by way of Informal Users Workshops (1990, 1991, 1992) in which the end-users of agricultural research were invited to discuss specific problem areas and identify researchable objectives. The results of these discussions have been provided to the NRICGP for consideration in the establishment and initiation of programs. Workshop attendees have included farmers and growers, processors, representatives of other agriculturally related businesses and industries, environmentalists, sustainable agriculturalists, consumers, and USDA administrators. Thus, representatives of the wide range of activities that agriculture encompasses, who would not otherwise ordinarily interact, were brought together to bring a broad perspective to setting priorities.

Special grant programs funded through CSRS are targeted to specific research areas where additional emphasis is desired. Water quality and global climate change are but two of these current programs.

In addition to setting priorities, initiating implementation, and conducting the research, we must also determine the extent to which we have made wise investments of research dollars, met the needs of our clients, and reached our goals.

Recently, CSRS completed a comprehensive review of research investments (1981–1991) and the impact derived from these investments. The report—"Dynamics of the Research Investment: Issues and Trends in the Agricultural Research System"—was published in July 1993. This publication is already being cited as a significant policy reference by scientists and administrators in the State agricultural experiment stations. To cite just a few examples of those results: developed processes for low fat, low cholesterol milk products; substantially reduced off-flavor in catfish; use of chemicals, ultraviolet light, and microorganisms to decompose pesticides into harmless compounds; Geographic Information Systems are being used to identify interrelationships among crop and soil characteristics, residential intensity, taxation and land use—it is now possible to compare the costs and benefits derived from alternative policy options intended to protect ground water; and a new "high tech" method has been developed to detect bacterial pathogens (*Salmonella* and *Shigella*) and viral pathogens (poliovirus) in ground water supplies.

In early 1992, ARS contracted an exploratory study of ARS/cooperative research projects completed during the period 1980–1990. Interviews were held with actual users of the research through field application, commercialization, or further research. Nearly half of the users provided estimates of ARS research contributions to sales or savings over the decade, totalling approximately \$14 billion. The research varied greatly in contributions to both producers and industrial use. For example, a single year's sales of a natural fiber ingredient in food yielded \$10 million, while genetic evaluation of dairy cattle contributed to sales or savings of nearly \$5 billion for dairy producers and breeders over an 11-year period.

The study revealed a wide array of different kinds of benefits, not all of which could be measured in dollars. They included: new or improved products for agricultural producers; new or improved processes for agricultural producers; industrial or commercial processes that were new or improved; new or improved commercial products; improved safety for producers, processors and consumers; testing or verification of products and processes; new or improved research and measurement techniques or equipment; and improvements in health, nutrition, or quality of life.

The benefits of ARS research in earlier years have included such important contributions as the development of an industrial process for mass producing penicillin; the development of frozen orange juice concentrate—now a \$400 million-a-year U.S.

industry; and the development of instant potato flakes, cotton blend garments, and screwworm eradication methodology. More recently, however, ARS research in the decade of the 1980's has produced vaccines that provide protection against poultry diseases; new range grasses for use in semidesert areas, which has resulted in the recovery of significant land areas as improved pastures; technology that enables producers to predict both the need and the times for pesticide applications that minimize impact on the environment and that lower the costs of inputs; techniques of biological control of weeds, plant diseases, and insect pests; new techniques for the protection of our food supply such as more effective assay methods for *Salmonella*, *Campylobacter*, *Listeria*, and *E. coli* 0157:H7; release of the Water Erosion Prediction Project and the Wind Erosion Research Model to the Soil Conservation Service for monitoring water and wind erosion, and many more examples I won't list here. With the use of biotechnology and other emerging technologies, we expect the decade of the 1990's to provide more products and processes to continue and enhance the well-being of the Nation and the world.

Mr. Chairman, let me touch briefly on a few areas in which this committee is particularly interested—biotechnology, sustainability, and new uses of agricultural commodities.

The USDA has established the Biotechnology Council which advises agency administrators on issues related to biotechnology. The Council has representatives from the research and regulatory agencies and meets on a regular basis. Input from the Agricultural Biotechnology Research Advisory Committee, made up of non-USDA scientists, mainly from the University community, and other agencies is received and integrated to address key policy issues. This Council specifically coordinates USDA biotechnology activities and develops recommendations for consideration by the Assistant Secretary.

CSRS and ARS jointly administer a competitive grants program called the Biotechnology Risk Assessment Research Grants Program (BRARGP), authorized by the Food, Agriculture, Conservation, and Trade Act of 1990, the purpose of which is to assist Federal regulatory agencies in making science-based decisions about the safety of introducing genetically modified plants, animals, and microorganisms into the environment. The BRARGP solicits a great deal of input from USDA and Federal regulatory agencies in establishing research priorities for the annual request for proposals. Proposals submitted to the BRARGP are subjected to rigorous peer review by scientists representing a broad range of scientific disciplines and by Federal regulators. The BRARGP also sponsors an annual research conference designed to promote the exchange of information between risk assessment researchers and regulators.

Sustainable agriculture involves a broad-based, interconnected network of technologies, practices, and systems to address current and future problems facing agriculture. The program's uniqueness lies in its support of agricultural systems where inputs and returns are optimized while protecting our natural resources and ensuring food safety. The basic foundation of all sustainable agricultural systems requires that they be economically viable, socially acceptable, and environmentally sound. Many of the required components of sustainable systems have been present for a long time and have been researched as part of other programs including soil conservation and erosion control, integrated pest management, and water quality.

In the area of new uses, ARS research has produced, for example, Super Slurper from starch, epoxy glues from soybean oil, and vinyl plastic stabilizers from soybean oil. The Alternative Agricultural Research and Commercialization Center authorized by the 1990 farm bill just recently made its first awards. The vast majority of the first round awards went to companies and organizations involved in development and commercialization of new crops and new products based on original ARS research.

Research supported by the NRICGP has produced some additional results of importance to agricultural industry. I will cite two examples. Sunflower head residues, now a waste product, can be used to replace an imported pectin. From 15 to 25 percent of a sunflower head residue is pectin which can be extracted for food or nonfood uses. This work is helping to establish a new commercial industry, reduce imports from Europe, and improve local farm economies. Calcium-magnesium acetate (CMA) is an environmentally safe, noncorrosive alternative to chloride salts used for highway deicing. Currently produced from petroleum products, CMA can also be used as an antifreeze/deicer for airports, as a heat transfer medium, and as a potential controller of emissions from high-sulfur coal combustion. Industrial microbiologists, geneticists, and biochemical engineers have worked together to produce CMA from corn through fermentation. Currently, research is focused on improving the fermentation process. The potential market for CMA as a deicer alone is \$2 to 6 billion and could use 200 to 600 million bushels of corn annually.

In setting priorities and implementing programs, we constantly strive to find the most efficient and expedient methods of responding to public needs. As I mentioned earlier, we solicit input from many sources, both of our own volition and with the assistance of Congress. As you are aware, the 1990 farm bill mandated the establishment of an Agricultural Science and Technology Review Board (ASTRB) which was charged to identify current and emerging science issues for priority setting and to provide technology assessment of current and emerging research and technology transfer initiatives within the public and private sectors. This technology assessment charge in turn has two elements: (a) to identify, or predict, the downstream consequences of research initiatives and new technologies on agriculture, environment, nutrition, rural communities; and (b) to guide research and education investment decisions. The ASTRB is just completing its first year of operation, and its initial report will be issued by the end of the calendar year. I understand that the Board will propose a methodology for technology assessment for USDA consideration and evaluation by the research community in the coming year.

In meeting the goals of our priority programs, we have another tool available to us as the result of Public Law 103-62, the Government Performance and Results Act of 1993. This legislation requires all Federal agencies to develop strategic plans, performance goals and measures, and performance-based budgeting by the 1997 to 1999 timeframe. Although USDA Science and Education agencies are generally in the vanguard on strategic planning, we will need to give future attention to performance measures. The Department as a whole is only in the formative stages of discussing approaches to meeting the requirements of the Act. We will be observing and evaluating models developed in establishing measurable performance goals and systems related to science and education programs.

Mr. Chairman, in summary, the U.S. Agriculture system is one of the largest positive elements in the U.S. trade equation; it has assets in excess of a trillion dollars; and it provides almost 20 percent of our Nation's employment. It is efficient and remains a mainstay for food and fiber production. Much of the U.S. success in the agricultural industry is founded in a strong, long-term commitment to agriculture and forestry research systems. As agriculture changes, so do the needs for new information and technology, making it important for the research community to be concerned about transitions in agriculture and agribusiness, as well as in related natural resource issues. Agricultural research has reached out to a broad spectrum of clientele to expand the dissemination of information and to better identify priority concerns that need to be addressed by agricultural research efforts tomorrow.

Mr. Chairman, in the interest of time, this will complete my prepared statement. My colleagues and I will be pleased to respond to questions and participate in the discussions.

United States General Accounting Office

GAO

Testimony

Before the Subcommittee on Agricultural Research,
Conservation, Forestry, and General Legislation,
Committee on Agriculture, Nutrition, and Forestry
United States Senate

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AGRICULTURAL RESEARCH

Refocusing Priorities to Meet Current Concerns

Statement of Robert A. Robinson,
Associate Director, Food and Agriculture Issues,
Resources, Community, and Economic Development Division



Mr. Chairman and Members of the Committee:

We are pleased to participate in this hearing today on the U.S. Department of Agriculture's (USDA) implementation of research priorities. We will be using a slide presentation to provide an overview of (1) the current structure and budget for agricultural research, (2) the new agricultural research objectives that have been introduced in recent years, and (3) factors that have inhibited the refocusing of the research agenda on these new objectives.

As you know, the nation's agricultural research system started in 1887 with the establishment of agricultural experiment stations. For almost a full century, the system's sole goal was to increase productivity. The system has done, and continues to do, a remarkable job in addressing that goal. However, in the current U.S. and world climate, more is being asked from our agricultural research system. The system is now being asked to respond to a host of new constituents beyond farmers. For example, new goals--such as finding ways to reduce the agricultural sector's impact on the environment, enhance food safety, improve human nutrition, increase market demand, and develop rural economies--have become critically important.

Although the world has changed and new research requirements have emerged, the federal agricultural research system still is aimed at achieving its traditional goal--namely, increasing agricultural productivity. If the system's priorities are to be significantly refocused to better address the multiple goals that now exist, a number of structural impediments will have to be overcome. I will discuss these later in my presentation.

ORGANIZATION AND FUNDING OF USDA'S RESEARCH AGENCIES

At the outset, it would probably be useful to offer some background information on the structure and funding levels associated with current agricultural research efforts.

Figure 1 shows how research is currently organized within USDA. As you can see, responsibility for agricultural research is spread out over a number of agencies under several assistant secretaries. Under this structure, the Secretary is the only person in a position to coordinate programs and provide oversight.

Figure 1: Organizational Structure of USDA Research

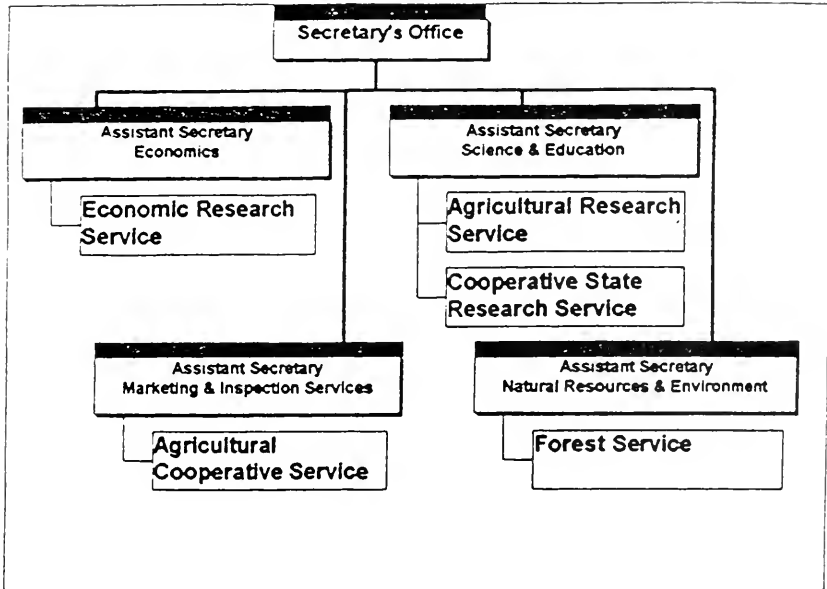
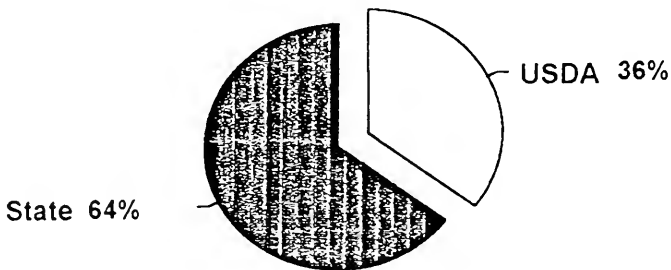


Figure 2 depicts the USDA and state shares of the nearly \$3 billion spent on agricultural research.¹ As you can see, research conducted at the state level represents about two-thirds of the funds, while USDA controls the other one-third.

Figure 2: Total Research Funding at USDA and State Institutions, 1991

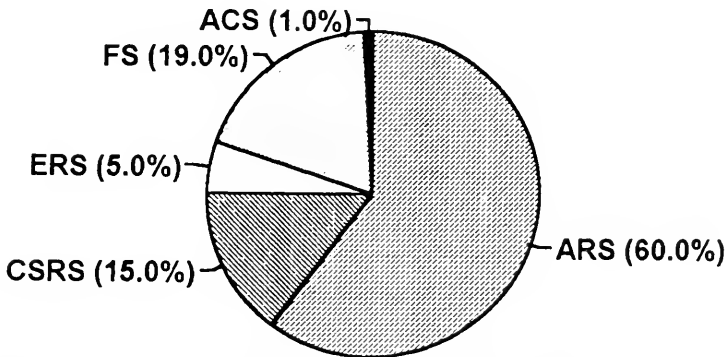


Source: Current Research Information System Fiscal Year 1991

¹Fiscal year 1991 data are the latest available.

Figure 3 breaks out and provides additional information on USDA's research efforts of approximately \$1 billion. As might be expected, the Agricultural Research Service (ARS) manages most (60 percent) of these research funds. The Forest Service is next, at 19 percent. The Cooperative State Research Service (CSRS), including only the special and competitive grants programs, is third, at 15 percent.

Figure 3: USDA Agencies' Funds for Research, Fiscal Year 1991

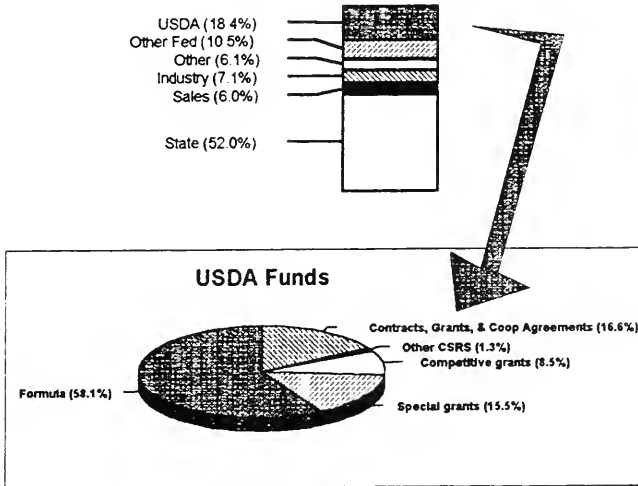


Source: Current Research Information System Fiscal Year 1991

With respect to the state-conducted portion of the research, figure 4 shows the original sources of the approximately \$2 billion in research funds ultimately managed by the states. While the states themselves contributed over half of this money, much of this effort was made possible by grants from USDA, other federal agencies, and the private sector.

The bottom half of figure 4 elaborates on the proportion of state funds provided by USDA. Formula funds, which are allocated by law and largely out of USDA's direct control, provide most of the USDA money. USDA's competitive grants--designed to be a source of funds highly responsive to changing needs and subject to more direct control over priorities--account for less than 10 percent of USDA's funding to states. USDA stated that within the special grants funding, more than one-half of these funds are earmarked by the Congress.

Figure 4: Funding Sources for State Agricultural Experiment Stations and Other State Institutions, Fiscal Year 1991



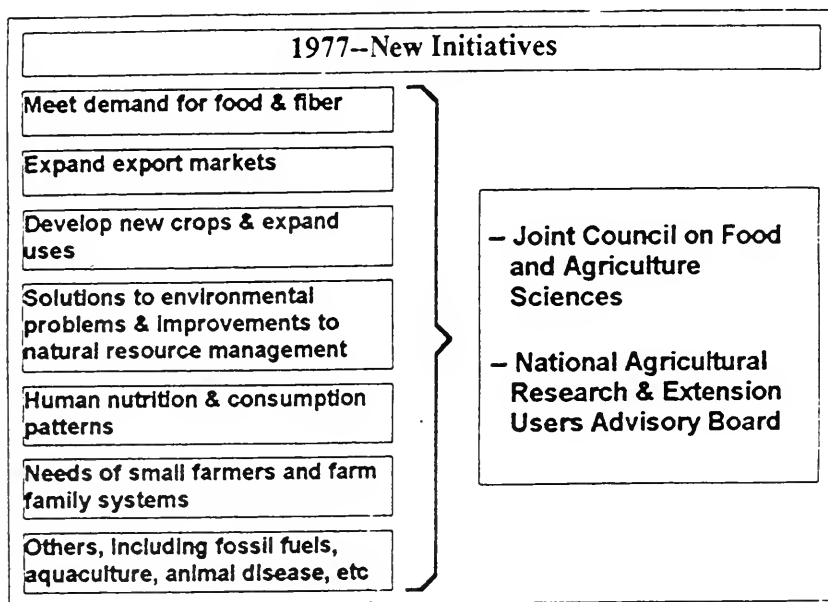
Source: Current Research Information System Fiscal Year 1991

Note: Includes Hatch Act, McIntire-Stennis Act, Evans Allen, and Animal Health and Disease Research funds.

NEW RESEARCH OBJECTIVES HAVE BEEN INTRODUCED

With this sketch of the organization of and funding for agricultural research in place, we now turn to the research priorities guiding the system. While agricultural research was historically aimed primarily at increasing production, a broader focus was brought to agricultural research in the 1970s with new environmental and societal concerns. With the 1977 farm bill, the Congress took steps to address this broadened focus. The farm bill identified new objectives for agricultural research. It also established two bodies to advise USDA on research priorities and assist in coordinating research--the Joint Council on Food and Agriculture Sciences and the National Agricultural Research and Extension Users Advisory Board. Figure 5 shows the research priorities set forth in the 1977 farm bill.

Figure 5: Research Priorities, 1977



This interest in a broader agenda for research continued in subsequent farm bills. As figure 6 illustrates, with the most recent 1990 farm bill, the Congress continued to identify essentially the same research priorities as it did in 1977.

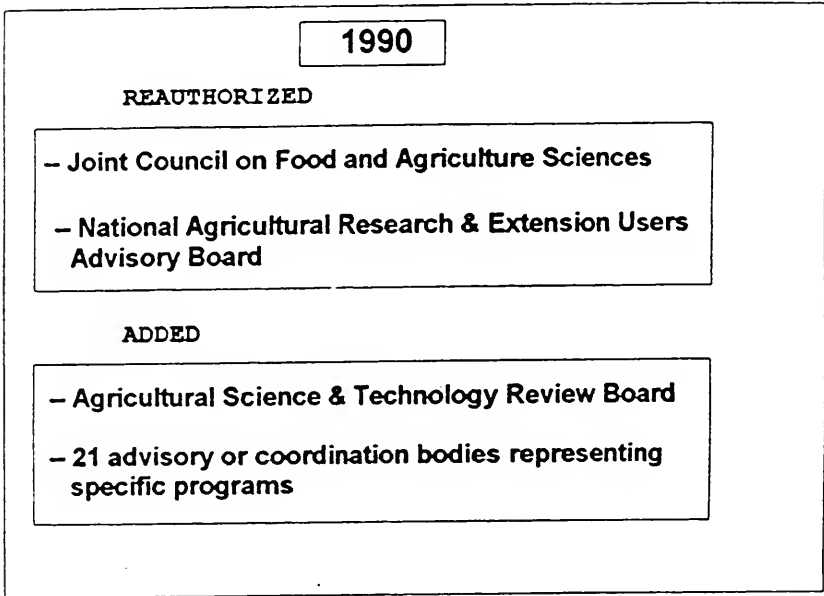
Figure 6: Research Priorities, 1977 and 1990

1977--New Initiatives	1990--Purposes of Research
Meet demand for food & fiber	Satisfy food & fiber needs
Expand export markets	Increase global competitiveness
Develop new crops & expand uses	Develop new crops & new uses
Solutions to environmental problems & improvements to natural resource management	Enhance environment and natural resources
Human nutrition & consumption patterns	Enhance human health
Needs of small farmers and farm family systems	Economy of rural America and improvements to farm life
Others, including fossil fuels, aquaculture, animal disease, etc.	

In addition, the 1990 farm bill reauthorized the boards established in 1977, created another departmental advisory board, and added 21 departmental advisory or coordinating boards addressing specific programs.

With so many advisory groups in place, USDA is hard-pressed to sort out these many voices as it attempts to devise a coherent priority strategy.

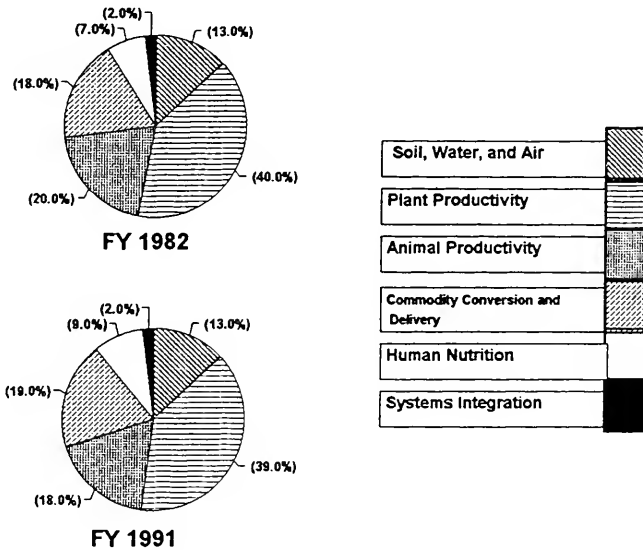
Figure 7: Research Advisory Bodies Established by the 1990 Farm Bill



Despite congressional efforts since 1977, existing USDA information suggests that most funds are still devoted to increasing agricultural productivity. The following figures provide information showing that funding by research categories has not significantly shifted to new research priorities over the past decade. However, USDA says that, within these categories of research for both ARS and the competitive grants program, changes have occurred in the types of research being done.

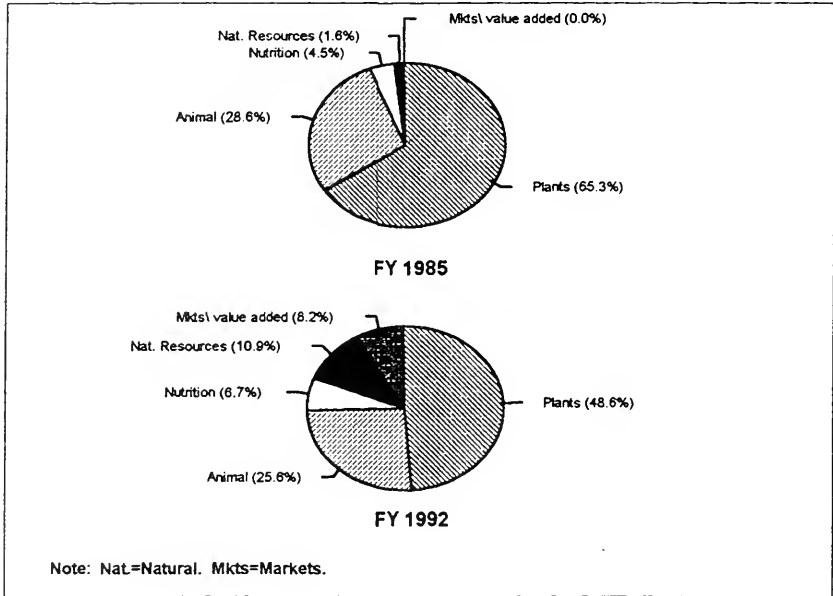
As shown in figure 8, ARS, the agency with the largest share of federal research dollars, has minimally adjusted its overall priorities over the last 10 years. For example, plant productivity--a traditional research area--is consuming 39 percent of total funds, down only 1 percent from 1982 levels. Furthermore, nutrition research--an area of increasing public concern--remains at less than 10 percent of total funding.

Figure 8: Percentage of Funding by ARS' Objectives



Finally, figure 9 shows how CSRS' Competitive Grants Program funds have been allocated since 1985, the year when CSRS began keeping project information by category of research.² The Congress designed this program to be more flexible in responding to new priorities. While some shift in priorities has occurred, the bulk of the funding still goes to traditional research areas--plant and animal research.

Figure 9: Competitive Grant Funds by Category



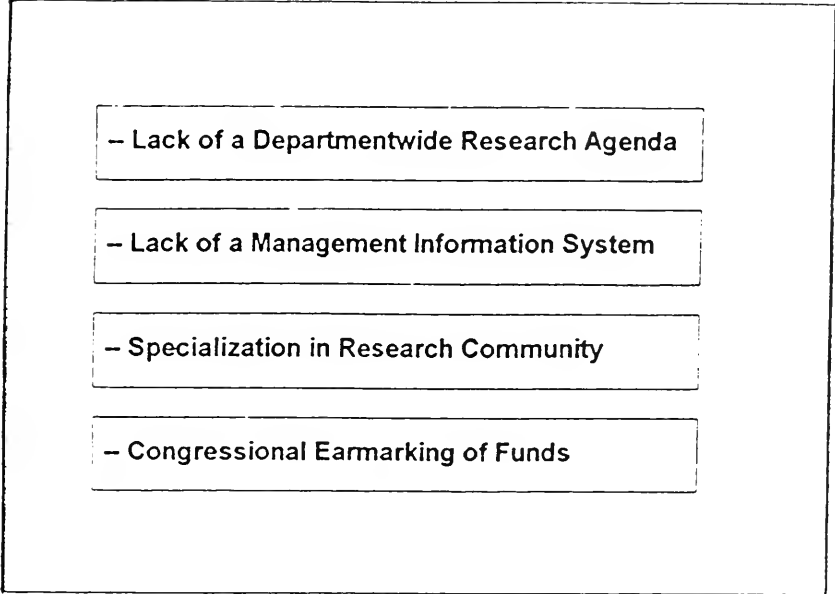
²Before 1985, the Competitive Grants Program primarily sponsored plant science research.

FACTORS THAT INHIBIT THE REFOCUSING OF RESEARCH PRIORITIES

Given the steps taken in previous farm bills, why haven't research priorities shifted more significantly to reflect current concerns with the impact of agriculture on the environment, nutrition, food safety, and rural development?

Figure 10 lists several factors, suggested by work that we have done or issues identified by USDA, that have slowed progress in refocusing research priorities.

Figure 10: Four Factors Inhibiting a Shift in Research Priorities

- 
- Lack of a Departmentwide Research Agenda
 - Lack of a Management Information System
 - Specialization in Research Community
 - Congressional Earmarking of Funds

First, while some component agencies have their own separate plans, USDA has no department wide research agenda--no vision of where agriculture should be in 10 or 20 years. Developing a national research agenda for agriculture will be a difficult task because (1) USDA is in transition, moving from a single focus to multiple priorities, and (2) consensus will be needed from many constituencies. Compounding this problem, as we discussed earlier, is USDA's lack of an organizational structure to facilitate the development of such consensus.

Second, the only national system with information on agricultural research is the Current Research Information System, commonly known as CRIS. CRIS was designed to compile descriptive information on current projects from researchers at all types of institutions and make this information accessible to the research community. It was not designed to be a management information system that would give managers the information they need to measure outcomes and analyze progress toward reaching goals or assess costs and benefits. Moreover, despite its name, CRIS is not current: Its reporting system is 2 years behind the fiscal year. Stated simply, CRIS is not, nor was it intended to be, a national system that allows agencies to identify successes and deficiencies and make needed adjustments.

Third, because specialization is inherent in scientific research, changes in the system occur slowly. Scientists who have spent years developing specialized expertise in traditional fields find it difficult to shift to emerging fields. Consequently, USDA's research agencies, which are dependent on these individuals, cannot redirect their priorities quickly.

Fourth, USDA has stated that congressionally earmarked funds hamper its ability to establish and shift research priorities. It has identified 107 projects in traditional research areas that were specifically mandated by the Congress.

- - - - -

In conclusion, a number of factors inherent in the research system that has evolved over the past century make shifting priorities a difficult and prolonged process. We believe these fundamental constraints will need to be confronted if the nation's agricultural research system is to address current needs with the same success that it has addressed historic ones.

We hope that our slide presentation has provided an informational framework that will facilitate your deliberations on this issue. We would be pleased to answer any questions that you may have.

(150811)

DR. TERRY L. NIPP

Mr. Chairman, I am pleased to appear before you and the subcommittee to discuss agricultural research priority setting and implementation. I appear on behalf of the Experiment Station Committee on Organization and Policy (ESCOP), which represents the State Agricultural Experiment Stations, within the National Association of State Universities and Land-Grant Colleges.

OVERVIEW OF THE SYSTEM

State Agriculture Experiment Stations

The State Agriculture Experiment Station system traces its origins to actions of the U.S. Congress, which recognized over 100 years ago the need for research to benefit agriculture, rural life, and the environment. This federated system for research, which balances the needs of the States, regions, and the Nation, is part of the land-grant university system, which began with the passage of the Morrill Act of 1862. This Act provided for education by establishing land-grant universities in every State and territory. Research was specifically added in 1887 when the Hatch Act was enacted and a State Agricultural Experiment Station (SAES) was established in each State to provide research to undergird the education mission of the universities. The Experiment Stations have organized themselves into four regional associations: North Central, Northeast, South and West. Each of the four regional associations has an Executive Director, formerly known as a Director-at-Large. The regional associations are responsible for facilitating coordination among the SAES program in the region, and to facilitate coordination with the other regions and national programs.

ESCOP

Directors of the SAES make up the membership of the Experiment Station Section of the Board on Agriculture, of the National Association of State Universities and Land-Grant Colleges (NASULGC). The executive committee of this section is known as the Experiment Station Committee on Organization and Policy (ESCOP). ESCOP serves as the institutional mechanism for facilitating national consensus among the SAES.

Federal and State Partnerships

Publicly supported agricultural research is conducted through agencies of the United States Department of Agriculture (USDA) and the national system of SAES's. The Hatch Act provided for a unique State-Federal partnership in funding the SAES's. The Cooperative State Research Service (CSRS) of USDA coordinates the Federal research programs of the stations and interfaces with other Federal agencies. The SAES's have the flexibility to respond to specific local and regional needs as they contribute to solving problems related to agriculture, natural resources, and rural communities. Their location at the land-grant universities in each State allows the research to be readily transferred to the classroom and the citizens, and facilitates cooperation with the agriculturally related programs in veterinary medicine, forestry, and home economics.

Linked together with the USDA in a State-Federal partnership, the SAES's represent a distributed system of semi-independent entities that must address both separate and interconnected needs and objectives. Site-specific research objectives, which may not be common to other States, are funded with State or local funds. Regional research funds (RRF) from the USDA/CSRS help solidify planning and coordinate the use of common resources for mutual benefit. Broader Federal funding of base programs and special and competitive grants motivate States to effectively communicate within their SAES and with other States at the regional and national levels.

The SAES's are also interconnected with academic programs and the Extension delivery system in the U.S. land-grant universities. Through the Cooperative Extension Service, the SAES's transfer research technology directly to the users. They form an effective link in this broader system of State and Federal institutions involved in research and development, including the USDA Agricultural Research Service, the USDA Economic Service, the U.S. Forest Service, and related programs in other areas of the U.S. Government.

The national system of SAES's represents over half of the scientists' time devoted to publicly funded agricultural research. Agencies within the USDA contribute most of the remainder. Given that the SAES make up more than half of the Nation's total investment in agricultural science, it is very appropriate that the SAES's participate, as a partner, in these discussions regarding agricultural research priority setting and implementation.

Strategic Planning

ESCOPE develops a Strategic Plan that is developed and maintained on a 4-year cycle. In the interim, three annual updates to the plan are issued. The first and third updates undergo a review by our Planning Committee and relatively minor changes are incorporated as needed. The second update, referred to as the Midterm Update, is a more substantive effort and offers the opportunity for input from the individual SAES directors and the ESCOP Regional Associations.

The current plan was developed in 1990 and went through a significant midterm update in 1992. A copy of the 1990 Plan and the 1992 Midterm Update are provided for the record.⁵ The 4-year reevaluation of the priorities in the plan was just completed in a workshop meeting this August. The findings of this most recent evaluation will probably be published in January. However, draft copies could be made available to the subcommittee sometime in November, if that is desired.

Planning Process

Strategic planning in the SAES's is an ongoing process with a grassroots approach that involves input from hundreds of consumers, producers, and researchers involved in agriculture, food, and the environment. Because ESCOP represents a broad array of State interests, and because there is a genuine attempt to consider fairly the input and suggestions of a diverse and sometimes competing set of interest groups and clients, our planning process may seem complex. To solicit internal and external recommendations for this process, ESCOP has defined mechanisms for State and regional input, "customer communication," a "Futuring Conference," and a "Strategic Planning Workshop."

State and Regional Input

The ESCOP strategic planning process begins with an assessment of the present State and Federal investment in the SAES base program. Analysis shows that the resources in the base program provide stability for long-term research objectives in agriculture, food, and the environment. In addition, a dynamic, ongoing reinvestment of these resources occurs at a rate of not less than 20 percent per year to meet changing needs and opportunities. As a result, much of the new agenda for agricultural research emerges from early studies performed within the base program. This internal analysis also shows where resources fall short in providing progress and momentum on critical issues for the 1990's.

A "Planning Group" solicits a list of proposed research initiatives and relative research priorities from the SAES Directors. Every State Director ranks the relative priority of a list of issue areas. The results of this ranking are compiled regionally as well as nationally, so that variations in priorities from one part of the country to another can be considered. A list of the proposed research initiatives, including relative priorities based on the vote of individual SAES directors, is submitted to the National Agricultural Research Committee to begin the USDA Joint Council process of establishing national research priorities as called for in the farm bill.

Customer Communication

Groups invited to submit input include: (1) national commodity and farm organizations; (2) environmental, conservation, and consumer groups; (3) processing, manufacturing, and input industries; and (4) professional and scientific societies. Internal input is requested from the ESCOP Special Initiatives Committee, university groups affiliated with ESCOP, and the Regional Associations of SAES Directors. A list of the groups that contributed to the 1992 Midterm Update is attached in the Update report.

To secure this input, a series of "Customer Conferences" are held, where national and "grassroots" representatives of the diverse "clients" are invited to sit down with ESCOP leaders and each other to discuss their preference and priorities. The Customer Conferences are organized around the six research priority areas identified in the 1990 farm bill: (1) environment and natural resources; (2) nutrition, food safety, and health; (3) processes and products; (4) economic and social issues; (5) animal systems; and (6) plant systems. Representatives of the different interest groups meet to discuss their priorities for research within these categories. The "Customer Conferences" were developed initially as a way to solicit input for establishing the priorities of the National Research Initiative, but the concept has now been expanded for consideration of the research priorities of our total State system. During the last several years, individuals nominated by sustainable agriculture groups have

⁵ Retained in the committee file.

been included in the groups discussing the six priority areas. This summer, a unique Customer Conference was held to solicit input specifically from representatives of the sustainable agriculture community on all of the priority research areas.

In addition to the Customer Conferences, ESCOP solicits written input from a long list of groups, including: (1) commodity and farm organizations; (2) natural resources and related industries; (3) environmental and consumer groups; (4) professional and scientific societies; and (5) Regional Association of Experiment Station Directors. ESCOP also evaluates planning documents developed by USDA and other Federal agencies.

Special Initiatives and Futuring Conference

It is, of course, important that we consider carefully the concerns and priorities that our diverse client groups have today. It is equally important, however, that we "look to the horizon" to consider the critical issues that our system needs to prepare to address tomorrow. It takes time for our vast system to reorient and "tool-up" to address new problems. It is therefore essential that we anticipate as many new areas of need before they become issues of concern. By way of example, a special ESCOP committee began meeting in 1982 to consider ground water contamination issues. A document outlining research issues that needed to be addressed to facilitate the protection of ground water from agricultural production practices was published in 1985, some 3 to 4 years before the development of the multiagency Water Quality Initiative supported by the recent administration. ESCOP supported and continues to support the Water Quality Initiative; the point is that ESCOP maintains a "Special Initiatives" Committee that has the responsibility of anticipating future areas of research interest.

In addition to the ongoing Special Initiatives Committee, a "Futuring Conference" is held where leaders and "visionaries" are asked to speak to the SAES community. The most recent Futuring Conference was held this summer.

Strategic Planning Workshop

Every 4 years, there is a complete reevaluation of the Strategic Plan at a major workshop to develop a new research agenda. Participants include practicing scientists, administrators, the SAES family and affiliate organizations, as well as State and Federal Government representatives. The results of the Customer Conferences, the written input, and the Futuring Conference are made available to the participants of the workshop, as they work to evaluate and integrate all of this information. The workshop is used to assess the relative priorities for new initiatives as well as defining research objective priorities.

Strategic Plan Components

The Strategic Plan has several purposes. It is used, of course, as a way of incorporating the input of diverse interest groups. It is also used as a way to develop consensus among the States regarding issues of national importance. The Plan is an "opportunity" document, not a budget proposal. In other words, it evaluates where we should go if we could. The Plan is used by the ESCOP Budget Committees, which evaluate and propose funding for the programs, through a budget document developed by the National Association of State Universities and Land-Grant Colleges.

The Strategic Plan is organized to discuss new priorities and objectives, but it also evaluates current resource and program dynamics. In the development of the Strategic Plan that will be released in January, there were discussions regarding the need to increase environmental research, to focus on sustainable agriculture and to emphasize systems research. There was considerable discussion regarding how "cross-cutting issues" can be addressed.

LINKAGES AND COORDINATION

Linkage to the 1990 Farm Bill and the NRI

The National Academy of Sciences/National Research Council's Board on Agriculture report (September, 1989) called for a major new National Initiative for Research on Agriculture, Food, and Environment. The 1990 farm bill recognized the six areas identified in the Academy report. There is intentional similarity between the SAES strategic plan and the research areas identified in the farm bill: (1) environment and natural resources; (2) nutrition, food safety, and health; (3) processes and products; (4) economic and social issues; (5) animal systems; and (6) plant systems. The SAES system is engaged in an array of research issues and funding mechanisms much broader than those supported by the National Research Initiative. However, for the purposes of creating a coherent and integrated agenda, there

has been a careful attempt to integrate our planning processes within these six category areas, as evidenced in the Strategic Plan.

Linkage to Regional and State Plans

Each of the SAES must respond to the priorities placed upon them by their State legislative bodies and they must respond to local needs and issues. Understandably, then, each State and region will create a unique blend of programs that respond to national and local concerns. Each region has a different process for facilitating the development of this blend of programs. The Southern Region has begun experimenting with a new approach, the principles of which might be adopted by some of the other regions in the future. I have provided a copy of the Southern Strategic Research Plan (August 1992) for the record.⁶ The Southern region took the national strategic plan as a format, and then described the unique environment and situation in the Southern region in regards to these priorities, and designed their research objectives accordingly.

Linkage to USDA planning processes

The SAES and ESCOP process is closely linked to the planning processes of the USDA Cooperative State Research Service, but there is also close dialog with the Agricultural Research Service, Extension Service, Human Nutrition Information Service, Economic Research Service, and Forest Service. The results of the State processes are also made available to the USDA Joint Council on Food and Agricultural Sciences. Attention is paid to the USDA Users Advisory Board. In the appendix of the midterm update of the Strategic Plan (February 1992), there is a description of the relation of the ESCOP priorities to the other USDA agencies engaged in priority setting.

Linkage to Budget Planning

In November 1987, ESCOP established a Planning and Budget Subcommittee, to more effectively integrate the related activities of the Special Initiatives Groups, the Planning Group, and the Budget Committees of ESCOP. The chairs of these groups, along with the Executive Directors of the Regional Associations, are members of the overall subcommittee and function as a board of directors for the several related groups. The ESCOP Budget Committees incorporate this information from the other committees in their deliberations regarding recommended funding levels for research funded through USDA/CSRS. These recommendations are integrated with the recommendations of other Budget Committees representing other parts of the University community. The compilation of these budget recommendations are included in a document entitled: Strategic Investments in Agricultural Research, Extension, and Higher Education, which is developed every year by the Budget Committee of the Board on Agriculture, of the National Association of State Universities and Land-Grant Colleges. An example report is provided for the record.⁷

CONCLUSION

Individual Experiment Stations and the SAES system as a whole are in the midst of profound change. Not only must the SAES's address changing demands and opportunities, they also are dealing internally with new institutional relationships that require them to reach beyond traditional college boundaries to achieve needed research results. For example, examining both the biological and social consequences of research is becoming more important. This creates the need for inter- and multidisciplinary research, which implies a new set of institutional relationships and rewards that do not always correspond to existing departmental and disciplinary structures. As land-grant institutions become more diversified, the role of agriculture in the total academic environment is being redefined, and the traditional land-grant mission is being reassessed in the context of how other parts of the institution evaluate performance.

The 1990's offer a combination of opportunities and challenges that are far greater than ever experienced in the history of the SAESs. Changing and expanded responsibilities, in addition to the continuing need to maintain and enhance the use of current technology, requires new approaches to old problems. Emphasis must be placed on broader societal concerns and goals, especially in the areas of environmental quality and food safety. As we respond to these challenges, we look forward to working with Congress and the administration as we implement a new mix of research priorities that will effectively address the challenges of today and tomorrow.

⁶ Retained in committee file.

⁷ Retained in committee file.

LETTERS

HON. THOMAS A. DASCHLE,
U.S. SENATE, WASHINGTON, DC, *July 26, 1993.*

Hon. CHARLES BOWSER,
Controller General, U.S. General Accounting Office, Washington, DC.

DEAR MR. BOWSER: The productive capacity of U.S. agriculture has been built upon research. Agricultural research has generated a stream of technological advances, which have long established the United States as the world leader in agricultural productivity. However, these advances have not been without some costs. Just as the agricultural research system has been credited for the many successes of the agriculture industry, it has also been faulted for contributing to a rapid decline in the number of family farmers and massive displacement of farm laborers, and for promoting agricultural practices that are environmentally destructive. Many critics, including some agricultural scientists, have sought in recent years to shift the agricultural research system's orientation. These critics suggest that agricultural research is not neutral, or value free, and has an expressed social and environmental agenda that has not served to foster a sustainable agriculture industry and healthy rural communities. Growing public concern over the challenges faced by agriculture and rural America has resulted in a call for the environmental and social consequences of agricultural research to be taken into greater consideration by the research community.

In 1990, Congress directed USDA to undertake a new comprehensive approach to Federal agricultural research and education activities in the writing of Title XVI of the Food, Agriculture, Conservation, and Trade (FACT) Act of 1990. The Subcommittee on Agricultural Research and General Legislation held a series of hearings on the state of our Nation's agricultural research. During those hearings, concern was expressed that publicly sponsored agricultural research lacks a meaningful and responsive priority-setting mechanism, is biased toward improving production in our system of high-input industrial agriculture at the expense of sustainable agriculture, and does not adequately focus on the needs of rural communities.

In response to the information gathered at those hearings, the subcommittee put together a proposal that became the basis for the research title of the 1990 farm bill. The research title established clear priorities, referred to as the "national research purposes," for agricultural research, Extension, and teaching programs. These priority-setting provisions were an attempt to improve the direction and mission of the agricultural research system by expanding priorities to include conserving natural resources, improving economic opportunities in rural America and enhancing the quality of life for farmers, rural citizens, and society.

In the 1990 research title, Congress articulated a continued commitment to the development of sustainable agriculture and authorized innovative research programs with an emphasis on the development of sustainable agriculture systems. The National Research Initiative, or NRI, was a significant reorganization and expansion of USDA's Competitive Research Grants Program. Established as a major growth area in agricultural research, the NRI was designed to support basic and applied research that focuses on both national and regional research needs, and on methods to transfer such research into practice.

As I prepare for reauthorization of the FACT Act, I will conduct oversight hearings to see whether the letter and intent of Title XVI, and particularly the NRI, have been implemented by USDA. Congress directed the NRI to fund basic and applied research of regional and national relevance in six priority areas: plant systems; animal systems; nutrition, food quality, and health; natural resources and the environment; engineering, new products, and processing; and markets, trade, and rural revitalization. The law calls for minimum percentages of funding to go toward multidisciplinary research (30 percent by 1993), "mission-linked systems research" (20 percent), and strengthening and opportunity grants to individuals and less competitive institutions (10 percent). The stipulation of minimum levels of support for multidisciplinary and mission-linked systems research was intended to shift prevailing research methods away from reductionist and isolated basic research toward whole systems, interdisciplinary and farm-relevant (mission-linked) research.

As an initial step in this oversight process, I request that GAO collect available baseline data on Title XVI implementation, particularly focusing on NRI's basic operation, and on the extent to which USDA has carried out the national research purposes. This initial step should also include a description of: 1) the fundamental organization of the Federal, agricultural research establishment; 2) how the NRI interacts with other segments of the research system; 3) how USDA, and specifically

NRI and ARS, has shifted research efforts as directed by Congress; and 4) what criteria USDA uses for reporting funding levels of specific research areas.

The question of reviewing shifts in agricultural research priorities is becoming more important, since the research budget will not increase every time a new research problem is tackled by the Federal research system. The research system must have a credible method of shifting funding priorities to meet the public need, and have a credible means of measuring the extent to which the Federal research system is meeting priority shift demands. Therefore, I would ask that GAO report on what USDA, and particularly the NRI and ARS, has done to shift agriculture research priorities to meet the needs of agriculture, rural communities, and general public (or consumers) as outlined by congressional directive, and determine what type of system is in place to assess the extent to which the Federal agricultural research system is meeting priority shift demands. I would also like GAO to make any suggestions as to how the USDA agricultural research system could improve its ability to meet the ever-changing national agricultural research priorities, and any suggested improvements for measuring the extent to which USDA agricultural research addresses national agricultural research priorities.

More specifically, I would like GAO to assist the subcommittee in obtaining the following information from USDA: 1) how NRI classifies research as multidisciplinary research and mission-linked systems research; 2) whether the NRI criteria, which defines multidisciplinary research and mission-linked systems research, are those commonly used by the agricultural research establishment; 3) how well NRI has carried out the procedures outlined in the NRI program planning document entitled "Research Objectives of the National Initiative," for convening user groups, science advisory groups, and developing researchable objectives; 4) to what extent the Request For Proposals (RFP) has directed scientists to prepare and submit proposals addressing the national research purposes and agriculture sustainability; and 5) whether the makeup of proposal review panels provides sufficient depth and breadth of expertise to ensure that the NRI, as a whole, meets congressional directives.

I understand that members of the subcommittee staff have discussed these issues with members of the Management, Organization, and Budget group in the Food and Agriculture Issues Area at GAO. I would like this group to provide the requested information in the form of a briefing in early September, 1993, and within that same month of September be prepared to provide testimony at a hearing if called upon to do so. Also, I would like your staff to continue to work closely with subcommittee staff to facilitate the transfer of information. Please contact Richard Hess at (202) 224-2321 on matters related to this request.

Sincerely,

(Signed) TOM DASCHLE,
*Chairman, Subcommittee on Agricultural Research, Conservation, Forestry, and
General Legislation.*

DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
WASHINGTON, DC, November 5, 1993.

Hon. THOMAS A. DASCHLE,
*Chairman, Subcommittee on Agricultural Research, Conservation, Forestry, and
General Legislation, U.S. Senate, Washington, DC 20510.*

DEAR MR. CHAIRMAN: At the October 7 hearing on research priorities, you requested we provide additional information for the hearing record on research program shifts that have occurred which were not reflected in the GAO report and on the guidelines that have been established to ensure that USDA research addresses the purposes enacted in the 1990 farm bill.

I am providing the attached information for the hearing record, and I wanted you to have a copy for your information. If you have questions, please contact me.

I appreciated the opportunity to participate in the subcommittee's hearing and engage in the dialog that reinforced the research community's commitment to science and the Nation's well-being.

Sincerely,

(Signed) R.D. Plowman,
Acting Assistant Secretary, Science and Education.

Enclosures

[The enclosures follow:]

AGRICULTURAL RESEARCH SERVICE

Program Adjustments Within Strategic Plan Objectives

The change in the Agricultural Research Service (ARS) program balance across the Strategic Plan Objectives has not been dramatic over the last 10 years. However, ARS has made significant changes *within* the program objectives. In 1984, ARS made a determination that no individual research project would continue longer than 5 years without a merit review of the science by at least three non-ARS reviewers. The Agency initiated a systematic review of all projects where the National Program Staff (NPS) has the responsibility to set the program objectives in consultation with the scientists and line managers to reflect the priorities of the users and the executive branch. Approximately 20 percent of the entire ARS program is reviewed each year in this process. The Agency has almost completed two cycles of review.

In 1990, 1992, and 1993, the Agency completed an internal process to prioritize (high to low) the entire program based on a series of evaluations by managers and NPS. After each process, the Agency used the evaluations to closeout/redirect/refocus the lowest priority programs. In the process, the Agency has redirected scientists to different locations, closed out specific programs, and in some cases effected a reduction in force of scientists and allied support staff.

The following table shows some specific changes in funding for selected programs and a narrative statement explaining the changes:

	(\$ In Thousands)	
	FY 1986	FY 1993
Water Quality	12,006	51,611
Animal Germplasm/Genome	7,800*	13,700
New Uses	51,709*	73,824
Food	26,563*	34,790
Non-Food	25,146*	39,034
Food Safety	23,852	35,989

*FY 1988 is initial year for collecting data.

Water Quality

Increasing public and congressional concerns during the 1980's that some of the chemicals used in cropland agriculture may be contaminating the Nation's drinking water supplies resulted in a substantial redirection of ARS resources into water quality. Research programs at more than 20 ARS field locations have been impacted by this redirection since 1986. Watershed research programs in Missouri, Ohio, Georgia, and Pennsylvania have been refocused from fundamental work on hydrology, soil physics, and runoff management to research on improved methods of plant nutrient, pesticide, and animal waste management, and evaluations of the effectiveness of riparian zones in protecting water quality. Water management research in South Carolina, Louisiana, California, and Idaho has been redirected toward more efficient use and reduced leaching of plant nutrients in irrigated agriculture. ARS locations that are contributing to the 1989 national initiative on water quality in several corn and soybean producing areas of the Midwest have made major adjustments to their programs to support this initiative. ARS research activities in Minnesota, Iowa, Nebraska, and Ohio have been affected by these internal redirections. ARS research in Maryland and Colorado on soil nitrogen dynamics associated with production agriculture has been redirected toward the loading of underlying ground water. Finally, several ARS locations in West Virginia, South Carolina, Mississippi, and California now directly support water quality initiatives of other USDA agencies, primarily the demonstration projects promoted by the Soil Conservation Service and the Extension Service.

Animal Germplasm/Genome Program

The USDA-ARS program in animal genetics has been one of the major national research programs that has improved the efficiency of animal production and the quality of animal products. In the last decade, significant advances have been made in human and animal molecular genetics. Use of this new technology in conjunction with traditional breeding programs will significantly increase the annual rate of genetic progress in animals. Only recently has society at large recognized the importance of conserving the genetic diversity of animals. The identification of animal genotypes will provide optimum access to desirable genes and gene complexes that will contribute to our future food and fiber supply. Since 1988, ARS has initiated

new research programs using recently developed technology to optimize the genetic potential of animals. The expenditure of funds for the ARS germplasm/genome program has increased from \$7.8 million in FY 88 to the FY 93 level of \$13.7 million. This increase of \$5.9 million was accomplished by the redirection of \$3.5 million of base funds from applied research in management, nutrition, and existing studies in genetics and a \$2.4 million increase received in new congressional appropriations for this area of research since 1989. Recent accomplishments as a result of new initiatives in the Animal Germplasm/Genome Program include: development of a national data base for breeds of livestock and poultry; development of a central repository to preserve unique germplasm at lower temperatures; and development of gene mapping research programs in cattle, swine, sheep, and poultry. It is expected that skeletal gene maps of the above species will be published in 1994.

New Uses

In the late 1980's, the congressional and executive branches initiated a major effort to increase the competitiveness of U.S. agricultural products in world markets. In addition, development of new products, especially nonfood, from bulk agricultural commodities was initiated. ARS has five major laboratories whose mission is on these major program thrusts. Using the internal review process, the Agency redirected \$12 million in 1990 within these five laboratories. Programs that were terminated/redirected/refocused were in the areas of basic plant science, quality, fibers, and projects in the centers that did not directly contribute to the mission of the center. New thrusts were initiated in conversion of starch to biodegradable plastics; conversion of vegetable oils to specialty chemicals; conversion of dairy products to higher valued products and/or lower fat content; and development of natural polymers that offer unique structures that are competitive in cost and function with those derived from nonrenewable resources. This concerted move toward higher value-added industrial products coupled with the efficient technology transfer system of ARS, has already led to the commercialization of several new products for U.S. industries.

Food Safety

The food safety program is focused on reducing the microbial, parasitic and chemical contamination of food. Increased concern with human pathogens carried by meat and poultry products, has dictated that new methods be developed to prevent microbial contamination at the source. The Agency has eliminated or reduced programs on plant toxicity; byssinosis, tobacco safety, mutagenicity, and trypsin inhibitors at several locations. The Agency has increased its efforts on zoonotic diseases such as trichinosis, toxoplasmosis, and cryptosporidia which can be transmitted to humans. Also, the Agency has increased its efforts on assessment and control of bacterial contamination such as *Salmonella*, *E. coli*, and *Campylobacter*. In plant products, the Agency has increased its efforts to reduce/eliminate the formation of mycotoxins, aflatoxin, and fumonisins which can be toxic to animals and humans.

In addition to these changes, the Agency has made significant changes in the plant and animal science programs as indicated below with specific examples.

Plant Science

During the last decade, ARS has made meaningful and deliberate shifts in emphasis of research programs in the broad area of plant productivity. There has been a deliberate decrease in developing improved varieties of major crop species—especially corn, soybean, wheat, rice, and tomato—and increased resources are being dedicated to the collection, evaluation, and preservation of plant genetic materials. ARS now concentrates on developing improved germplasm lines and encourages the private sector to develop and release varieties for commercial production. There has also been a conscious effort to greatly reduce research on plant spacing, selection of varieties, soil fertilization, irrigation, chemical pest control, and other cultural studies of specific crops. These responsibilities have been left to individual States as cultural practices vary tremendously with soil, rainfall, temperature, and other environmental factors. There has also been less effort on development and application of chemical pesticides. Resources formally used for cultural practices and chemical pesticides were redirected to research on improved methods of biocontrol of major economic pests. While research on development and application of biological control pest management systems is expensive and more difficult to show immediate control of pest problems than chemical pesticides, there are greater benefits to preservation of the environment and sustainability of agricultural productivity. The boll weevil eradication project now being used by cotton farmers in the Southeastern States is based on ARS research and has proven to be extremely effective. For example, in North Carolina cotton acreage has now increased by tenfold, yields have doubled, and pesticide use has been reduced by 80 percent. ARS has also initiated

new programs in support of rural development and small farm enterprises. In the current fiscal year, ARS redirected \$500,000 for the establishment of a new nursery crop research program at Tennessee State University, an 1890 institution, which will help diversify agriculture in the Mid-Atlantic States.

Animal Science

A major strength of ARS is the capability to form, disband, or coordinate interdisciplinary research teams when emergency needs arise or priorities change as a result of significant breakthroughs in science. For example, in 1992 the Animal and Plant Health Inspection Service of the USDA and the livestock industries requested that ARS initiate a research program in tuberculosis. The clients indicated that tuberculosis was their highest priority research need and agreed that ARS could reduce/terminate other animal health programs in order to redirect resources (dollars and people) to tuberculosis. ARS has reduced the program on paratuberculosis and brucellosis and terminated the program on calicivirus at the National Animal Disease Center and now has almost \$700,000 devoted to research on tuberculosis. These actions demonstrate the ability of ARS to change the program within program objectives and to redirect resources to quickly address emergency concerns.

COOPERATIVE STATE RESEARCH SERVICE

The Cooperative State Research Service (CSRS) and the partner institutions have responded to new initiatives through the redirection of Federal, State and other nonfederal funds for high priority research. While not all inclusive, the following figures demonstrate the impact of redirections in supporting research in biotechnology, water quality, nutrition/food and aquaculture. Guidance in directing the use and allocation of formula funds is provided in administrative manuals prepared by CSRS. Program oversight is provided in the review and approval of program plans prepared by individual institutions and individual projects that are reviewed by CSRS scientists before funds are obligated by institutions.

Directions for the use of competitive grants program funds are provided in the request for proposal guidelines published annually in the Federal Register. This provides guidance to institutions and investigators as to which priority areas will be funded under these programs. A competitive peer review process ensures that funds are directed towards priority research projects.

CSRS RESEARCH FUNDS SPENT PER PRIORITY RESEARCH AREA

	1987				1992			
	CSRS	%	Total CSRS, State, other non-Federal R&D	%	CSRS	%	Total CSRS, State, other non-Federal R&D	%
Biotechnology	40,578	15.0	135,400	10.4	73,464	17.6	248,898	14.6
Water Quality	15,994	5.9	101,659	7.8	31,846	7.6	144,337	8.1
Nutrition/Food	14,656	5.4	62,858	4.8	24,109	5.8	81,951	4.6
Aquaculture	8,971	3.3	26,837	2.0	17,753	4.2	41,327	2.3
Total CSRS R&D	270,754				418,193			
Total CSRS, State, other non-Federal R&D	1,033,146				1,362,066			

AGRICULTURAL RESEARCH SERVICE

Farm Bill Purposes and Guidelines Information

The Agricultural Research Service (ARS) Implementation Plan is a principal means of informing ARS personnel, users, Congress, and other interested parties about the agency's research program objectives. ARS published an addendum to that 6-Year Implementation Plan in April 1993, specifically to express the policies of, and to provide guidelines to, the agency with regard to the national agricultural research purposes enacted in the 1990 farm bill. The addendum was distributed to all ARS locations and scientists. ARS established a series of Special Classification

codes, FBP1 through FBP6, that reflect the six purposes stated in the farm bill. Each National Program Leader (NPL) was responsible for reviewing each project for which they have primary responsibility to determine the code(s) that best describe the main thrust of the project. The NPL could assign one or more codes to an individual project. In addition to the specific code(s), the NPL assigned a percentage to each code(s) so that the total on the project equaled 100 percent. The review process was completed by March 30, 1993, and the data were entered into the agency data base. As new projects are initiated, it is the responsibility of the individual project leader to determine the proper codes that will be assigned to the project, which includes commodity, activity, strategic plan and numerous special classifications including the farm bill purposes. The proposed codes are reviewed by line managers and the NPL before the project and codes are made part of the official data base.

As of October 6, 1993, the results of the classification coding of ARS research projects were as follows:

FBP(1)—continue to satisfy human food and fiber needs;

—[\$112,313,390 (17 percent)]

FBP(2)—enhance the long-term viability and competitiveness of the food production and agricultural system of the United States within the global economy;

—[\$132,133,400 (20 percent)]

FBP(3)—expand economic opportunities in rural America and enhance the quality of life for farmers, rural citizens, and society as a whole;

—[\$33,033,350 (5 percent)]

FBP(4)—improve the productivity of the American agricultural system and develop new agricultural crops and new uses for agricultural commodities;

—[\$145,346,740 (22 percent)]

FBP(5)—develop information and systems to enhance the environment and the natural resource base upon which a sustainable agricultural economy depends;

—[\$112,313,390 (17 percent)]

FBP(6)—enhance human health by (1) by fostering the availability and affordability of a safe, wholesome, and nutritious food supply that meets the needs and preferences of the consumer, and (2) by assisting farmers and other rural residents in the detection and prevention of health and safety concerns;

—[\$125,526,730 (19 percent)]

ADDENDUM TO AGRICULTURAL RESEARCH SERVICE PROGRAM PLAN

Six-year Implementation Plan—1992–1998

INTRODUCTION

The Agricultural Research Service (ARS) Implementation Plan is a principal means of informing ARS personnel, users, Congress, and other interested parties about the agency's research program objectives. This addendum supplements the 1992–1998 plan,¹ the third in a series since 1984.^{2,3} The 1992–1998 plan and this addendum establish areas of research emphasis in response to changing national needs and priorities and outline the strategies and policies ARS will use to achieve them. The primary objectives of this addendum are to quote the purposes of agricultural research set out in the 1990 farm bill⁴ and to state ARS policies that address these purposes.

¹Agricultural Research Service Program Plan. 6-Year Implementation Plan, 1992–1998. U.S. Department of Agriculture, Agricultural Research Service. 1991.

²Agricultural Research Service Program Plan. 6-Year Implementation Plan, 1984–1990. U.S. Department of Agriculture, Agricultural Research Service. 1983. (Out of print.)

³Agricultural Research Service Program Plan. 6-Year Implementation Plan, 1986–1992. U.S. Department of Agriculture, Agricultural Research Service. 1985. (Out of print.)

⁴Public Law 101–624; November 28, 1990. Food, Agriculture, Conservation, and Trade Act of 1990.

As the in-house research arm of the U.S. Department of Agriculture, ARS' mission is to:

Develop new knowledge and technology needed to solve technical agricultural problems of broad scope and high national priority in order to ensure adequate production of high-quality food, fiber, and other agricultural products to meet the nutritional needs of the American consumer, to sustain a viable food and agricultural economy, and to maintain a quality environment and natural resource base.

ARS has primary responsibility to:

- Provide initiative and leadership in agricultural research.
- Conduct research on broad regional and national agricultural and related problems.
- Conduct research in support of Federal action and regulatory agencies.
- Provide technical expertise to meet national food, food safety, and environmental emergencies.
- Serve as an agricultural science resource to the executive and legislative branches.

ARS programs are centrally planned and coordinated. The agency manages the scientific and operational activities of 127 locations, which comprise a network of geographically dispersed national and overseas laboratories. As a national research organization, ARS provides:

- Ability to perform long-term, high-risk research.
- Ability to respond to both stable and rapidly changing technical goals.
- An organizational structure ensuring research program accountability and coordination.
- Ability to focus research on gaps in knowledge that are barriers to solving problems.
- Capability to form, disband, or coordinate interdisciplinary or multilocation research teams from a large, diverse scientific work force of over 2,600 research scientists, including postdoctoral research associates.

For research planning and resource allocation, the ARS program is divided into six areas, called objectives:

Objective 1—Soil, water, and air conservation

Objective 2—Plant sciences

Objective 3—Animal sciences

Objective 4—Commodity conversion and delivery

Objective 5—Human nutrition

Objective 6—Integration of systems

The objectives are further divided into problem areas and scientific approaches.

PURPOSES OF AGRICULTURAL RESEARCH

Section 1402 of the 1990 farm bill (Public Law 101-624, Food, Agriculture, Conservation, and Trade Act of 1990) states:

Subject to the varying conditions and needs of States, Federally funded agricultural research and extension programs shall be designed to, among other things, accomplish the following:

- (1) continue to satisfy human food and fiber needs;
- (2) enhance the long-term viability and competitiveness of the food production and agricultural system of the United States within the global economy;
- (3) expand economic opportunities in rural America and enhance the quality of life for farmers, rural citizens, and society as a whole;
- (4) improve the productivity of the American agricultural system and develop new agricultural crops and new uses for agricultural commodities;
- (5) develop information and systems to enhance the environment and the natural resource base upon which a sustainable agricultural economy depends; or
- (6) enhance human health by:
 - Fostering the availability and affordability of a safe, wholesome, and nutritious food supply that meets the needs and preferences of the consumer.
 - Assisting farmers and other rural residents in the detection and prevention of health and safety concerns.

ARS POLICIES

Congress has established the above national agricultural research purposes to ensure that ARS and other federally funded agricultural research is directed toward benefiting the public and society in its entirety, including advancing the goals of agricultural sustainability and economic opportunities in family farming and rural communities.

Therefore:

Within the scope of ARS' mission, responsibilities, and program objectives, all ARS research projects are to be directed to one or more of these purposes.

The agency will establish program criteria related to these purposes to guide the peer review and approval processes for all new and revised research projects in ARS.

ARS scientists and program officials will classify and code all research projects according to their relevance to these purposes.

ARS scientists and program officials will interpret research findings according to their relevance to these purposes and will direct technology transfer activities to advance the goals of these purposes.

ARS program officials will set research priorities and support research projects that advance the national research purposes.

ARS scientists and research units will be recognized and rewarded for their achievements in advancing the goals of the purposes through established mechanisms for personnel and program evaluation.

QUESTIONS FROM SENATOR DASCHLE AND USDA RESPONSES THERETO

DOCUMENTATION NEEDED DEPARTMENT-WIDE

Question 1. How does the Department set its overall strategic goals/priorities for research?

Answer. The Department establishes and communicates to its science and education agencies overall policies and program objectives to carry out the priorities of the President and Congress. These priorities and objectives are in part based on recommendations to the Congress and the Secretary from congressionally authorized advisory committees, such as the Joint Council, Users Advisory Board, National Genetic Resources Advisory Council, and others. In addition, the action and regulatory agencies (Food Safety and Inspection Service (FSIS), Animal and Plant Health Inspection Service (APHIS), Soil Conservation Service (SCS), etc.) of the Department communicate to the research agencies their research priorities to ensure that the action and regulatory programs are based on scientific principles and data. For example, each State SCS office holds a joint research assessment workshop each year with the Agricultural Research Service (ARS) and State Agricultural Experiment Station scientists. In response to the established policies and strategic goals, the agencies, in turn, propose specific research needs and priorities to the Department based upon bottom-up and external input from the scientific community and its many external customers. Priorities for research are documented in various reports to the Congress, the farm bill and other legislation, annual budget proposals, and individual agency strategic plans.

Question 2. How does the Department hold agencies within USDA accountable for those goals?

Answer. The Department ensures that funds appropriated by Congress for specific programs and functions are expended only for those items. This is required by law. Each agency administrator is responsible for ensuring the accountability of funds. Oversight is provided at the Departmental level by the Office of Budget and Program Analysis, Office of Inspector General, and the National Finance Center. External oversight is provided by GAO, OMB, and Congress. Some examples of program goals being met are the Water Erosion Prediction Project and the Wind Erosion Research Model delivered by ARS to the Soil Conservation Service for monitoring water and wind erosion; the protocols delivered to the Animal and Plant Health Inspection Service for quarantine and fumigation of various plant and animal commodities prior to importation into the United States; and technology delivered to the Food Safety and Inspection Service to ensure the safety of using irradiation on food products to ensure safety and to increase shelf life of various products.

Any scientist or engineer receiving funding through the ARS or the Cooperative State Research Service (CSRS) is required to submit and have approved a research proposal outlining research goals and procedures. Near the end of each calendar year, progress, accomplishments, and technology transfer activities must be reported back to the sponsoring agency. On occasion, agencies also cosponsor conferences, symposiums, and workshops to aid in the exchange of research results among scientists and other groups interested in the utilization of such research information. Proceedings from these meetings are often published and distributed to a wider audience.

Question 3. How do individual research agencies establish their priorities and how are they assured: 1) that they support Department goals, and 2) that research conducted or supported by different agencies is not duplicative?

Answer. 1) Individual agencies have published long- and short-range strategic plans reflecting Department policies and goals, and inputs from the science community and external customers. The Department has reviewed these plans to ensure that they are addressing the Department's goals and needs. In addition, the annual budget review process is a mechanism for ensuring that departmental goals and needs are addressed by the research agencies.

2) Recently, the Secretary announced a reorganization of the research and Extension programs as part of his USDA-wide restructuring plan. Consolidation of research and Extension functions will lead to improved coordination of the programs. Under the existing structures, the Department coordinating committees to foster communication and joint planning are established among agencies that have complementary responsibilities within the same program function, for example, food safety, water quality, pest management, human nutrition, global climate change, etc. Additionally, formalized priority setting and technology transfer liaison activities are established between research and action agencies, such as ARS and FSIS. At the laboratory level, scientists from different agencies and institutions, including federally supported universities, conduct research planning workshops. The Office of Budget and Program Analysis (OBPA) works at the Department level to ensure that annual Agency budget requests are complementary and coordinated.

Additionally, the Experiment Station Committee on Organization and Policy (ESCOP), composed of State Agricultural Experiment Station directors and their representatives, is a major mechanism for priority setting in CSRS. ESCOP, in coordination with CSRS scientists, develops a Strategic Plan for Research. Priorities are first established at the regional level and then compiled at the national level. Priorities for specific focused regional or State formula-funded research, within the umbrella of CSRS research priorities, are established by the associated State Agricultural Experiment Stations. Among competitive special grant programs, general priorities are established by Congress and specific priorities are established by planning and evaluation committees composed of university and agency research scientists as well as representatives from external groups including Federal and State agencies, business and industry, and nonprofit organizations. Congress sets priorities for special research grants of regional or local interest and for facilities grants.

DOCUMENTATION NEEDED ON ARS AND CSRS

Question 1. Provide support for the statement in ARS's 1992-1998 strategic plan (page 7) "Little change has occurred in the balance of funding across objectives since 1982 because of continued ARS response to user priorities and accountability for earmarked appropriations." In particular, document changes in the amount of resources dedicated to specific priorities due to earmarked funds and user priorities.

Answer. In 1983, ARS published in the first 6-Year Implementation Plan a planned distribution of the Agency resources among broad program objectives for 1990 and has continued those targets in the second and third versions of the plan. In brief, the targets were to reduce the overall percentage of funds in the plant and animal science programs and to increase the other four strategic plan objectives (natural resources, commodity conversion, human nutrition, and integrated systems). In 1983, 40 percent of the Agency resources were in the plant sciences program and the 1990 goal was to reduce the level to 33 percent. By 1992, an actual reduction of only 1 percent had occurred due to several factors: the Agency's inability to redirect funds from one program area to another due to concerns raised by either clients, executive or congressional interests; modest budget increases in other program objectives were not sufficient to cause a major shift in the percentage balance distribution of funding across objectives; many of the major problems surfacing in the 1980's had a plant science component (e.g., water quality, global climate change, narcotics, sweetpotato whitefly and others); and a large number (107 of 269) of the congressionally appointed budget increase add-ons were in the plant science program area.

Question 2. What criteria does CSRS use to place research projects into their specific categories (e.g., biotechnology; soil, air and water; plant systems; etc.)? How does this categorical classification differ among funding categories (e.g., formula funds, competitive grants, and special grants)?

Answer. Research projects are classified into specific categories and entered into the national data base using a standardized system developed by the Current Research Information System of CSRS. The same classification system is used for all

categories of funding through CSRS. The data base is readily accessible by the entire research community and other users.

The classification scheme addresses the project's relationship to six different areas of concern: the research problem area, activity, commodity, field of science, and special classification. The research problem area can include one or more of the 98 topics outlined under nine major agricultural research goals of the original long-range study "A National Program of Research for Agriculture." Activities describe the purpose or nature of the research effort and provide either a broader or more specific focus for one or more related research problem areas. Commodity generally relates to the object of the research, be it a plant, animal, organism, material, process, or procedure under investigation. Disciplines involved in conducting the research are identified under field of science as used by the National Science Foundation. A special classification category allows the scientists to further delineate the focus of the research especially as it reflects local, regional, national, or discipline interests such as pollution, tobacco-health, poverty, integrated pest management, and energy.

Question 3. What criteria does ARS use to place projects into specific categories: (e.g., biotechnology; soil, air and water; plant systems; etc.)? Are there different funding mechanisms within ARS, and do the classification categories differ from one mechanism to another?

Answer. In the 1960's, USDA developed the Current Research Information System (CRIS) to document the research program carried out by the various agencies and established a coding system for commodities, activities, and special classifications. In 1983, ARS published its Strategic Plan which adopted a hierarchical classification scheme as follows: Objective, Approach, Approach Element, and Problem. The Strategic Plan is used to display the ARS program in six major objectives: Soil, Water, and Air; Plant Sciences; Animal Sciences; Commodity Conversion and Delivery; Human Nutrition and Well-Being; and Systems Integration. Using the above-mentioned classification schemes, ARS requires the individual scientist to classify his/her research project with oversight provided by line and staff managers of the Agency. All of the codes, except the special classifications, are mutually exclusive where the dollar resources for a given classification (i.e., commodities) must equal the dollars assigned to an individual project and the total of all projects equals the Agency budget. The Special Classification codes (i.e., biotechnology, IPM, sustainable agriculture) can overlap in their definition and this results in the multiple counting of some resources which makes the total of all Special Classification codes in some cases be greater than the total on an individual project and the Agency budget. ARS has only one funding mechanism for the research program and another for facilities. The classification codes only apply to the research funds.

DOCUMENTATION NEEDED ON NRI

Question 1. Provide documentation describing how NRI classifies and evaluates research as: 1) multidisciplinary and 2) mission-oriented research. Explain how definitions of these two categories were reached, considering the differing views in the scientific community.

Answer.

a. Multidisciplinary Research:

The current definition of multidisciplinary research used in the National Research Initiative Competitive Grants Program (NRICGP) is "Research in which scientists from two or more disciplines are collaborating closely. These collaborations, where appropriate, may integrate the biological, physical, chemical and/or social sciences." This definition, which appeared in the 1993 Program Description and which is also included in the 1994 Program Description, has evolved in response to comments from various communities since the initiation of the NRICGP. Specifically, in the 1991 Program Description of the NRICGP, it was stated that research by multidisciplinary teams would be supported but no definition of what constituted such research was given. In 1992, multidisciplinary research was defined as "Research in which scientists from two or more disciplines are collaborating closely for a common goal." The NRICGP believes that the current definition clearly encourages establishment of broad collaborations, a concern of various groups. It can be noted that the NRICGP definition is in accord with the working definition developed by USDA in August, 1992. It is as follows: "Multidisciplinary research is research which involves expertise from two or more disciplines or specialties combined in a coordinated and complementary fashion to discover new knowledge about scientific principles and/or to develop the knowledge and technology needed to solve complex technical agricultural problems."

b. Mission-oriented Research:

Although the NRICGP has not formally defined "mission-oriented" research, it has synonymously used the term "mission-linked" research, announced support for "mission-linked" research (1991 Program Description) and further defined (1992, 1993, 1994 Program Description) such research to include "Research on specifically identified agricultural problems which, through a continuum of efforts, provides information and technology that may be transferred to users and may relate to a product or a process." The USDA working definition of mission-linked research is "research, fundamental or applied, to develop new knowledge and technology targeted to solving technical agricultural problems of broad scope and high national priority." Such a definition is consistent with the NRICGP definition. Both definitions were developed with input from various communities. The USDA definition more explicitly recognizes that both fundamental and applied research are necessary in order to solve specific problems of agricultural significance.

Question 2. Provide detailed documentation to show that NRI has convened user groups and science advisory groups and how NRI has developed research objectives as defined in the NRI program planning document entitled "Research Objectives of the National Initiative." In addition, document the outcomes of these efforts, including the objectives developed and results of groups convened.

Answer. Since the onset of the program, the NRICGP has sought and received input regarding programmatic content from a number of different groups. Informal Users Workshops were convened in 1990, 1991 and 1992. Advice and recommendations for researchable objectives were solicited and received from these groups. Members of these workshops included producers, environmentalists, sustainable agriculturalists, consumers, and administrators. Research Planning Committees are convened when necessary to give more specific recommendations for the call for proposals. These groups are composed of scientists with expertise in a wide variety of topics. In addition, meetings with representatives from the various USDA agencies (ERS, ARS, FS, ES, CSRS) are convened annually for each NRICGP Division to gain input prior to the writing of the call for proposals. With this input, the scientific staff drafts the Request for Proposals, commonly called the RFP. Finally, the approval of the RFP ultimately comes from the NRICGP Board of Directors chaired by the Assistant Secretary for Science and Education. Serving on the Board of Directors are the administrators of CSRS, ARS, ES, ERS, Deputy Chief for Research of the FS, and the Chief Scientist of the NRICGP. The Associate Administrator of OGPS serves as Executive Secretary for this group. Below is a list of the various groups that have been convened since the onset of the NRICGP. Enclosed are the outcome reports from these groups.

Research Planning Committees

Animal Systems
Plant Systems
Natural Resources and Environment
Nutrition, Food Quality, and Health
Markets, Trade, and Policy
Plant Genome
Processing for Value Added
Reorganization of Natural Resources and Environment

User Workshops

Grain Crops
Processing
Horticulture and Forestry
Small Grains
Oilseed and Fiber Crops (2)
Animal Agriculture
Forestry and Forest Products
Food Processing
Agribusiness
Horticulture
Environment and Conservation
Consumer Affairs

Question 3. Explain how management is assured that the panels that review proposals contain scientists with the experience in multidisciplinary and sustainable agriculture research necessary to meet the legislative intent to foster research in these areas.

Answer. Because the proposals received by the NRICGP and those reviewed within a single panel encompass a broad range of disciplines, panels are constituted to consider a wide variety of topics, whether single or multidisciplinary. Panels are constituted only after the proposals have been received so that proper expertise can be obtained. Because proposals may be from many disciplines, a wide variety of experts within assorted disciplines must be recruited for a panel. For example, the Forest/Rangeland/Crop Ecosystems Program was comprised of scientists with expertise in soils, crops and cropping systems, forest biology and forest management, wildlife ecology, plant pathology, entomology, ecological risk assessment, satellite imagery, agroforestry, landscape ecology, and geographical information systems.

Additional expertise is sought through written reviews from ad hoc reviewers who provide specific expertise. Ad hoc reviewer comments are provided to the panelists prior to the panel meeting so that they may be discussed during the panel deliberations. The combination of panelists and ad hoc reviewers provides a broad evaluation of the merits of the proposal, whether the topic is single or multidisciplinary.

The NRICGP uses as one evaluation factor "Relevance of project to long-range improvements in and sustainability of U.S. agriculture or to one or more of the research purposes." Panelists and ad hoc reviewers are given instructions to comment upon and discuss this issue in their review. Most panelists have a broad range of experiences in agriculture, agricultural research, and sustainable agriculture, and can make valuable comments regarding the merits of the proposals using this and the other two evaluation factors, scientific merit and the qualifications of the applicants.

Question 4. Provide examples from the RFPs that demonstrate the solicitation of multidisciplinary and mission-linked research.

Answer.

Examples of Solicitation of Multidisciplinary Research in the 1994 RFP

Page 2—" * * * no less than 30 percent (anticipated FY 1994 funding, \$27.690 M) of the funds listed above shall be made available for grants for research to be conducted by multidisciplinary teams * * *."

Page 4—Types of Proposals (column 1): "The NRICGP solicits proposals that are single or multidisciplinary; fundamental or mission-linked." Further defined: "Multidisciplinary Research: Research in which scientists from two or more disciplines are collaborating closely. These collaborations, where appropriate, may integrate the biological, physical, chemical and/or social sciences." Also following in specific guidelines for multidisciplinary teams: "The NRICGP recognizes the value of research performed as a team effort * * *."

Page 4—Project Types: "Research will be supported that is fundamental or mission-linked conducted by individual investigators, co-investigators within the same discipline, or multidisciplinary teams."

Page 11—Animal Division description: "Multidisciplinary research is encouraged, especially research that integrates relevant scientific disciplines and links together components of food animal production systems."

Page 11—Enhancing Reproductive Efficiency program description (column 2): "Multidisciplinary research is encouraged."

Page 11—Improving Animal Growth and Development program description: "Multidisciplinary research is encouraged."

Page 12—Identifying Genetic Mechanisms and Gene Mapping program description: "Multidisciplinary research is encouraged."

Page 13—Sustaining Animal Health and Well-Being program description: "Multidisciplinary research is encouraged."

Page 15—Plant Genome program description: "* * * well-coordinated multidisciplinary proposals designed to bring complementary talents to bear on mapping needs, are encouraged."

Page 17—Photosynthesis and Respiration program description: "Multidisciplinary approaches are encouraged."

Page 18—Nitrogen Fixation/Nitrogen Metabolism program description: "Multidisciplinary approaches are encouraged."

Page 19—Markets, Trade, and Rural Development division description: "Multidisciplinary studies are strongly encouraged for both areas."

Page 21—Enhancing Value and Use of Agricultural and Forest Products description: "Multidisciplinary efforts that include identification of attributes and estimating their value under conditions where market prices for such attributes are not observable are encouraged."

Page 43—Evaluation Factors—Standard Research Grants, Postdoctoral Fellowships, and New Investigator Awards (col 1): "However, because Section 2(b)(10) of the 1965 Act, as amended, requires not less than 30 percent of the funds appropriated to carry out section 2(b) to be available for research conducted by multidisciplinary teams and requires not less than 20 percent of the funds appropriated to carry out section 2(b) to be available for mission-linked research, CSRS reserves the right to reevaluate standard research grant proposals to attain these amounts."

Examples of Solicitation of Mission-Linked Research in the 1994 RFP

Page 2—"no less than 20 percent (anticipated FY 1994 funding, \$18.460 M) of the funds listed above shall be made available for grants for mission-linked research."

Page 3—Research Opportunities (column 1): “In order to focus limited resources in selected areas of fundamental and mission-linked research that have the potential to expand the knowledge base needed * * *”

Page 3—Research Opportunities, Plants division: “The Plant Genome program will continue to provide opportunities in mission-oriented research targeted for the identification, characterization, alteration, and manipulation of genes controlling plant traits important to agriculture and forestry.”

Page 4—Types of Proposals: “The NRICGP solicits proposals that are single or multidisciplinary; fundamental or mission-linked.” Mission-linked is further defined: “Research on specifically identified agricultural problems which, through a continuum of efforts, provides information and technology that may be transferred to users and may relate to a product or process.”

Page 4—Project Types, Conventional Projects: “Research will be supported that is fundamental or mission-linked * * *”

Page 14—Genomes, Genetics, and Diversity description: “The Plant Genome program area (52.1) will support mission-oriented studies to produce low density maps, localized high density maps, and development of methods with high potential applicability to crop and forest improvement.”

Page 15—Plant Genome program description: “Potential applicants to the NRICGP Plant Genome Program area are advised that this is a mission-oriented, targeted program area. As such, the program is seeking proposals that are not only of high scientific quality but also are of high potential applicability to the understanding and improvement of crop and forest species.”

Page 21—Enhancing Value and Use of Agricultural and Forest Products: “The aim of mission-linked research in this program is to build the scientific base of knowledge to use agricultural and forest materials more fully and effectively in food and nonfood products.”

Page 43—Evaluation Factors—Standard Research Grants, Postdoctoral Fellowships, and New Investigator Awards (col 1): “However, because Section 2(b)(10) of the 1965 Act, as amended, requires not less than 30 percent of the funds appropriated to carry out section 2(b) to be available for research conducted by multidisciplinary teams and requires not less than 20 percent of the funds appropriated to carry out section 2(b) to be available for mission-linked research, CSRS reserves the right to reevaluate standard research grant proposals to attain these amounts.”

****In Addition**, in the pending supplemental RFP, the NRICGP will solicit 4 new programs—Agricultural Systems, Biological Control Research, Improved Pest Management Strategies, and Water Resources—that are mission-oriented programs that will solicit multidisciplinary approaches.

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